Understanding information technology appropriation in organisations

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Doctor of Philosophy

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Design and Social Context Portfolio
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February, 2011

Declaration

I, Justin James Torneff Fidock, certify that:

- except were due acknowledgement has been made, the work is mine alone;
- the work has not been submitted previously, in whole or in part, to qualify for any other academic award;
- the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program;
- any editorial work, paid or unpaid, carried out by a third party is acknowledged;
- ethics procedures and guidelines have been followed.

Justin James Torneff Fidock

23 February 2011

Acknowledgments

This thesis would not have been possible without the support of the participating organisations, or without the patience and support of the many people who contributed their precious time to participating in this research. This thesis would also not have been possible without the tremendous support provided by my employer, the Defence Science and Technology Organisation. My superiors made a significant investment in supporting this research and I hope that I have and will continue to demonstrate the value of this investment in my ongoing support to the appropriation of technologies in Defence.

A number of people assisted me in completing this thesis. I would like first and foremost to thank my supervisor Dr Jennie Carroll for her encouragement, guidance, support and enthusiasm. She maintained a belief in my ability to meet this challenge, even when I experienced doubts. You helped make the journey so rewarding. I also wish to thank my parents for their encouragement, and my friends and colleagues Dr Steven Talbot and Dr Diane Pomeroy for their advice and support.

Finally, I would like to thank my wife Jennie and children, Lucy, Emily and Henry. Jennie, your support, patience and guidance were a great source of strength. Doing a PhD is a road less travelled, but it was made so much easier by your experience of the journey. Lucy, Emily, and Henry, being your Dad has kept me grounded and focused on the things that really matter – family and friendship. The thesis might have taken longer because of you, but the delays were worth every minute.

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Abbreviations

ADF	Australian Defence Forces
COL(E)	Colonel (Equivalent)
CPL(E)	Corporal (Equivalent)
EDMS	Electronic Document Management System
HQ	Headquarters
IM	Information Management
MANOVA	Multivariate Analyses Of Variance
MS	Microsoft
SD	Standard Deviation
SOP	Standard Operating Procedure
IT	Information Technology
IS	Information Systems
ADEL	Army Doctrine Electronic Library
KMS	Knowledge Management System
AKD	Army Knowledge Domain
E-mail	Electronic mail
DSTO	Defence Science and Technology Organisation
PTE	Private
SGT	Sergeant
WO	Warrant Officer
LT	Lieutenant
CAPT	Captain
GEN	General

Abstract

This thesis develops understanding of the appropriation of information technology (IT) artefacts over time. Perceptions that the whole lifecycle of IT use, from pre-use, then initial use through to adaptive and stabilised use is not well understood were evaluated and supported in the initial part of the study. A generic lifecycle model of use, the model of technology appropriation (MTA), was chosen as the foundational theory for this thesis because it covers the entire IT use lifecycle, and it can be contextualised for different technologies, and user cohorts. The model was contextualised, tested and extended through data collected from three case studies that provided coverage of the entire lifecycle and involved a prototype information portal, a document management system that had been recently implemented, and an e-mail client. Defence was selected so as to provide an extreme organisational context which manifests strong structural and cultural imperatives to control use. Despite these imperatives, the findings demonstrated changes in users' patterns of appropriations over time and heterogeneous patterns of appropriation across individuals. In addition, influences on patterns of appropriation differed throughout the lifecycle. The findings were used to contextualise the MTA by including case specific influences and patterns of appropriation. Contextualisation was followed by a critical evaluation of the fit between the core elements of the model and case findings, where the core elements represent those features of the model that exist prior to contextualisation. Whilst the MTA facilitates understanding of appropriation, the model was enhanced through: modifying core elements of the model; incorporating teleological, dialectic and evolutionary generative mechanisms; and including contextual features associated with appropriation of the IT artefacts studied. This research has produced a richer and more complete understanding of the use lifecycle in organisations than prior research. Achieving this enhanced view of the use lifecycle was supported by employing a combination of methods suited to examining the contribution of each of the generative mechanisms. This research therefore makes important theoretical and methodological contributions to the information systems field, as well as providing a basis for providing more informed guidance on how to improve the appropriation of IT artefacts in organisations.

Chapter 1: Introduction

1.1 Overview

This thesis develops understanding of the appropriation of information technology (IT) artefacts over time, and reflects this understanding through the refinement and extension of theory. A range of studies in the research literature and candidate theories that provide insights into the use or appropriation of IT artefacts over time are evaluated. The review of these studies and theories demonstrates that understanding of use and appropriation over time is only partial, since very little research has considered the whole lifecycle of IT use, from pre-use, then initial use through to adaptive and stabilised use. A generic lifecycle model of use, the model of technology appropriation (MTA) is selected as the foundational theory for this thesis because it covers the entire IT use lifecycle, and it can be contextualised for different technologies, and user cohorts. However, the MTA is somewhat limited in its ability to explain the how and why of the appropriation process. It also has had limited application in organisational contexts. This thesis addresses these gaps through investigating the following overarching question and associated research questions:

Why do users' appropriations of IT artefacts vary?

a. What are the influences on appropriation in a particular organisational context?
b. What are the patterns of appropriation in a particular organisational context?
c. How effective is the MTA in building understanding of variations in users' appropriations in organisations?
d. In what ways can the explanatory power of the MTA be improved?

The MTA is contextualised, tested and extended through data collected from three case studies within Defence that provide coverage of the entire IT use lifecycle. Defence is selected so as to provide an extreme organisational context which manifests strong structural and cultural imperatives to control use. Findings from each case provide insights into how users' appropriations vary over time, and vary across individuals despite the constraining characteristics of the context. In addition, influences on patterns of appropriation are examined. The findings are used to contextualise the MTA for the particular organisational contexts by including case-specific influences and patterns of appropriation. The MTA is also contextualised to provide a description of all three cases combined. In addition, the capacity of the core concepts associated with the process of appropriation to describe and explain the

findings is examined. Reflection on the contextualised models, and the utility of the core concepts, is used to develop enhancements to the explanatory power of the MTA in general and for organisations in particular.

The remainder of this chapter lays the foundations for and provides an overview of this thesis. This thesis refines and extends theory suited to understanding why users' appropriations of IT artefacts vary over time and across individuals. Following Grover et al.'s (2008) guidance on strong theory writing, the motivation for this thesis is outlined. The boundaries of this study are provided through describing the MTA and its scope, as well as the associated phenomena of interest. Key propositions associated with the MTA are also considered. The core concepts associated with the MTA are briefly defined. The research design is outlined as is the structure of the thesis. The chapter closes by highlighting the key empirical, conceptual, theoretical, methodological and practical contributions of this thesis.

1.2 Motivation

Considerable resources are invested in IT artefacts designed to improve the productivity of organisations. However, many of these systems are underutilised, misused or avoided altogether and as a consequence they fail to generate the desired improvements in productivity. Understanding use and the influences that shape patterns of use is therefore an important concern for information systems (IS) researchers and practitioners (Benbasat & Zmud 2003; DeLone & McLean 1992; Karahanna et al. 1999; McLean et al. 2002; Trice & Treacy 1988). There is considerable research that considers one or two phases of the IT use lifecycle. However, very few studies have examined changes in influences and patterns across the whole lifecycle of IT use, from pre-use through to stabilised use. The lifecycle is neither well understood nor do most theories account effectively for use across the lifecycle. By investigating the appropriation of IT artefacts across the phases of the lifecycle of use, and by refining and extending a model that cover all of the phases (the MTA), contributions to IS research and practice are provided. Such contributions go beyond prior research focussed on only a subset of the lifecycle. Adopting a lifecycle perspective, and developing an enhanced understanding of the lifecycle, also assists in identifying the conceptual, theoretical and methodological limitations of partial views of the lifecycle.

1.3 The model of technology appropriation: a theory for understanding the lifecycle of IT use

The (MTA) was developed by Carroll et al. (2002a) to provide understanding of the process of appropriation through which technology is evaluated by people over time and adopted, adapted and incorporated into their practices (see Figure 1.1).

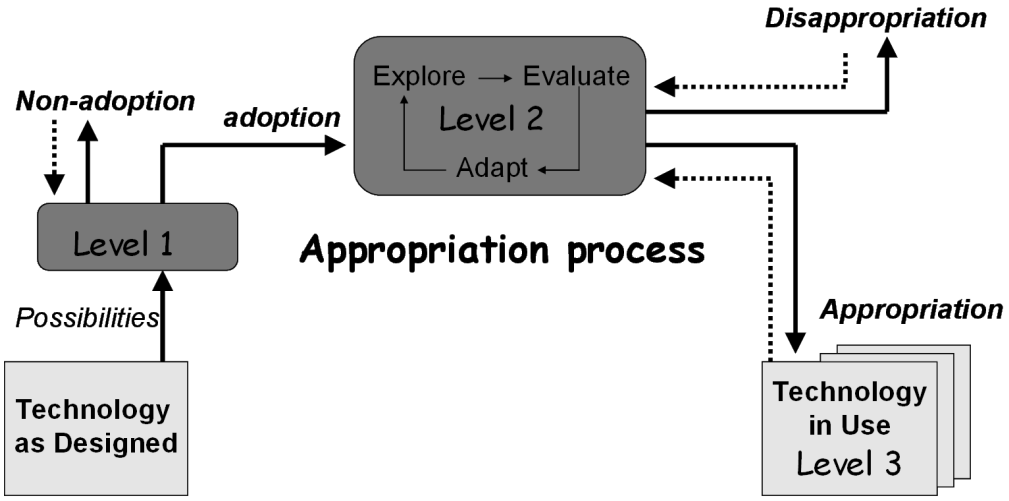


Figure 1.1 The model of technology appropriation (Carroll 2004, p. 5)

The model proposes that as people appropriate a technology they are completing the design. This is reflected by the transition from 'technology as designed', which is the technology as initially presented to potential users, through to 'technology in use', which represents the technology as incorporated with users' practices. Completing the design occurs as users adapt the technology and adapt their practices over time. 'Technology in use' is associated with practices around use of a technology becoming routine. It is proposed that 'technology in use' is user specific, that patterns of appropriation are heterogeneous across individuals (represented by the stacked boxes in Figure 1.1).

The model describes the appropriation process, which encapsulates the transition from 'technology as designed' to 'technology in use'. The appropriation process is characterised by movement through three phases: initial exposure, adaptation and incorporation. At each phase users evaluate a technology, with a variety of influences shaping these evaluations and associated decisions and actions. Each of these phases corresponds to a different level of evaluation, with each level leading to different outcomes. During initial exposure, when users are presented with a variety of possibilities for addressing their needs, level 1 evaluations

shape the decision to adopt or not adopt the technology. These two outcomes reflect a decision to try and use a technology to support one's practices (adoption) or a decision to not use the technology (non-adoption). Following adoption users engage in level 2 evaluations during which they evaluate a technology more deeply through exploring and learning how the technology is able to support their practices, and in the process they may adapt the technology and associated practices (adaptation phase). Overtime, adaptations diminish and cease, with the practices around the use of the technology becoming routine (incorporation phase), referred to in the model as appropriation. Evaluations at this phase provide impetus to maintain this state of appropriation (level 3 evaluations). However, circumstances can lead to a re-evaluation of the technology (refer to dashed arrow from 'technology in use' back to level 2), including renewed adaptation or even disappropriation, whereby the technology is rejected. Re-evaluation of the technology can also occur following non-adoption and disappropriation such that the technology enters into use (refer to dashed arrows from non-adoption back to level 1 and from disappropriation back to level 2).

There are four primary ways used in the model to convey different features. Arrows capture processes or movement from one condition to another. Solid arrows represent transitions from one phase of appropriation to another, as well as capturing the outcomes of users' evaluations. Words in bold and without boxes reflect outcomes of evaluation (non-adoption, adoption, disappropriation and appropriation). 'Possibilities' is also without a box, but reflects an input to level 1 evaluation. The two sharp edged boxes containing 'technology as designed' and 'technology in use' draw attention to the completion of design via the appropriation process. The two round edged boxes capture the evaluation process for the initial exposure phase (level 1) and the adaptation phase (level 2). Level 3 evaluation was not so represented because it is collocated with 'technology in use'.

1.4 Phenomena under study and core concepts

The phenomena under study are the appropriation of IT artefacts over time by users in organisations. There are three key elements associated with these phenomena: the appropriation of the technology to support users' practices; the technology itself, the IT artefacts designed to provide certain functionality and composed of various features; and the contexts within which appropriation occurs. The MTA serves as the foundational theory for understanding these phenomena as it directly accounts for the first key element. The MTA is

also intended to be contextualised for particular user cohorts and technologies which are situated together within particular contexts. The model therefore provides an account of the remaining two elements.

The MTA is used in this thesis to understand technology appropriation. Technology appropriation is the process through which technology is evaluated by people over time and adopted, adapted and incorporated into their work practices; and through which the design of technology is completed through use (Carroll et al. 2002a). Over time people can be thought of as taking possession of the technology (Carroll 2004). Technology appropriation also contains the idea of mutual adaptation; people adapt their practices associated with the technology as well as adapting the technology itself[1].

The focus of this thesis is not on technology appropriation in general but the appropriation of IT artefacts in particular. Following Benbasat and Zmud (2003), this thesis adopts the view that the IT artefact is core to the information systems discipline. An artefact is "something created by humans usually for a practical purpose" (Merriam-Webster Online). An IT artefact is a special case of an artefact which serves as a resource in support of processing information. IT artefacts include computer hardware, software, and networks (Alter 2008; Orlikowski & Iacono 2001).

Key concepts associated with the MTA include: adoption and non-adoption; adaptation; appropriation and disappropriation; 'technology as designed' and 'technology in use' (see Figure 1.1). Adoption and non-adoption are clearly associated with the initial exposure phase of the MTA (Carroll 2004). Adoption involves a decision to use a technology to support one's practices, and non-adoption when a decision is made to not use the technology.

Adaptation is the act or process of modifying (adapted from (Merriam-Webster Online)). In the case of IT artefacts, it is the act or process of modifying the artefact. Modifications to the technology artefact can include personalisations, customisations and inventions (Desouza et al. 2007). Additional synonyms include reinvention (Johnson & Rice 1984) and tailoring (Trigg & Bødker 1994). Modifications to associated practices are evidenced by changes to work practices, as well as changes in patterns of feature use. Synonyms include workarounds

[1] Core concepts used in this thesis are listed and defined in the Glossary.

and improvisation (Hayes 1999). Modification to both the artefact and the associated practices is described as mutual adaptation (Carroll 2004).

Appropriation is a state associated with the final phase of the MTA where the practices around the use of the technology become stable or routine, and no further adaptations to the technology occur (Carroll 2004). Technology appropriation is also used as a superordinate term that encompasses a range of subordinate concepts including adoption, adaptation, stabilisation and disappropriation. The later concept entails rejection of a technology, such that it is no longer employed to support a user's practices (Adapted from Carroll (2004)).

'Technology as designed' is the technology as initially presented to potential users (adapted from Carroll (2004) and Carroll et al. (2002a)). It embodies an underlying theory or spirit about how an artefact should be employed (DeSanctis & Poole 1994). This theory or spirit is strongly informed by the intentions of the designer/s. 'Technology in use' is the technology as it is currently used in the context of routine or stable practices (adapted from Carroll (2004) and Carroll et al. (2002a)). It is synonymous with the state of appropriation or incorporation that defines the final phase of the appropriation process.

An important element of appropriation is use of IT artefacts by users. Like appropriation, use is used in verb and noun form. As a noun, use is "the act or practice of employing something" (Merriam-Webster Online). Synonyms of use (noun) include usage and utilisation. In verb form, use entails putting an artefact "into action or service" (Merriam-Webster Online). Utilise and employ are synonyms of use (verb). Whilst use is an element of appropriation, the latter covers more conceptual terrain than use, something which is examined in chapter 2 and chapter 8.

1.5 Outline of the research design

The design of this research combines qualitative and quantitative research approaches, shaped by the research questions and the realist pragmatist frame adopted by the researcher. This combination provides the statistical rigor, control, efficiency of data collection and analysis of a quantitative survey-based approach. It also provides the richness of data and sensitivity to context, both current and historical, afforded by a qualitative process orientated approach. A multiple case longitudinal design is adopted, where each case is located in Defence, an

organisational context suited to testing and extending theory concerned with technology appropriation. The combined cases provide a means of exploring all of the phases of the appropriation process, and therefore afford coverage across the entire lifecycle of IT use, from pre-use through to stabilised use.

The first case investigates the appropriation of a knowledge management system, the Army Knowledge Domain (AKD) prototype. This case covers the initial exposure phase of the appropriation process (see Figure 1.2). The second case involves the appropriation of an electronic document management system (EDMS). This case examines the adoption decision and the adaptation phase of the appropriation process. The third case considers users' appropriations of electronic mail (e-mail), a mature and pervasive technology that is embedded with work practices. Coverage is provided of the incorporation phase of the appropriation process, as well as the adaptation phase.

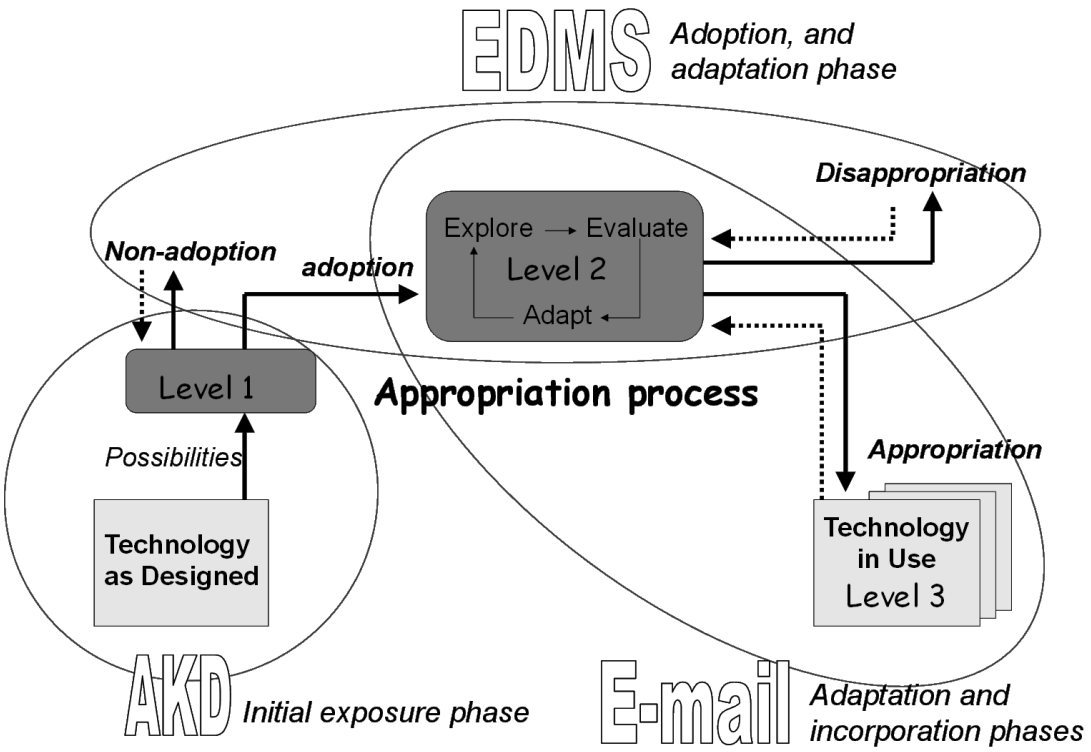


Figure 1.2 Mapping of IT artefacts onto the appropriation process

The organisational context selected to investigate the research questions was Defence. Defence provides an extreme organisational context which manifests strong structural and cultural imperatives to control use and thereby limit adaptations and variability in patterns of appropriation across individuals and over time. However, the MTA broadly predicts that

adaptations to technology and associated practices will occur over time and that patterns of appropriation across individuals are likely to be heterogeneous. Defence therefore is well suited to examining the effectiveness of the MTA in building understanding of variations in users' appropriations in organisations. If evidence of heterogeneous and dynamic appropriations is found in such a constrained context then this would suggest that the MTA has utility in less constrained organisational contexts.

Defence is a large organisation composed of approximately 90000 personnel. It has a number of groups that serve the government in a variety of ways and operate somewhat autonomously. The primary distinction between personnel is between military and civilians. The military make up around 73000 personnel, of which approximately 20000 are Reservists (Department of Defence 2008). The three main groups or services are the Royal Australian Navy, Australian Army, and the Royal Australian Air Force. Defence public servants constitute the remaining 15000 who support the services in various ways, such as in the acquisition and management of technologies, or the provision of advice on science and technology.

1.6 Outline of the thesis

This thesis is composed of eight chapters. Chapter 1 provides an overview of and provides a foundation for the rest of the thesis. Chapter 2 identifies a gap in the literature with respect to conceptualising and theorising about the whole lifecycle of IT use. Whilst there are a range of theories that explain use, only the MTA covers the entire lifecycle. The MTA is seen to incorporate many of the strengths of the other models but is somewhat lacking with respect to explaining the how and why of changes in patterns of appropriation over the lifecycle. Additional theories or motors of change are therefore introduced, each of which entails particular generative mechanisms, which could be incorporated with the MTA as a way of addressing this weakness. These generative mechanisms explain how and why changes unfold (Van de Ven & Poole 1995); they are the basic or underpinning dynamics that sustain and generate the phenomena of interest (Contractor & Seibold 1993).

Chapter 3 outlines the design of the research. This chapter considers the role of research approaches in shaping the description and explanation of phenomena. For the phenomena of use and appropriation of technologies, a research approach combining qualitative and

quantitative approaches is advocated, underpinned by a realist pragmatist philosophy. The research questions are outlined. The rationale behind adopting a multiple case study design with cases drawn from Defence is explained, as is the selection of participants. Five broad classes of methods are then described including consideration of the types of data provided and their application in this research. The measures and questions selected to investigate influences on and patterns of appropriation are summarised, as is the data analysis and theory building approach.

The next three chapters describe the findings from each of the three cases. Each chapter is structured as follows:

- important features of the IT artefact, associated practices and technologies, and the particular organisational context are outlined to provide a case description.
- the research methodology is explained.
- the qualitative and quantitative results are presented, which, together with the case description, are used to contextualise the MTA for each case.
- the findings are then examined through each of the four generative mechanisms.

The cross-case analysis is found in Chapter 7. The chapter begins with a brief assessment of the similarities and differences between the EDMS, AKD prototype and E-mail cases. A cross-case analysis of the qualitative and quantitative data is then presented. The findings are used to contextualise the MTA for the three cases in combination, as well as supporting an argument to include prior appropriations and technology portfolios in the model. An enhanced MTA that is potentially applicable to Defence and to organisations in general is then proposed by addressing issues raised about the MTA in this research, and by drawing on the generative mechanisms. The emphasis in this chapter is on description, with implications considered in the next chapter.

In chapter 8 the influences and patterns identified over the lifecycle are considered in the context of the wider literature. Key concepts for understanding the process of appropriation are described, as well as modifications and additions to the core concepts from the MTA. The value of going beyond the use concept to employ appropriation is also examined. Attention then turns to critically evaluating the utility of the MTA in support of understanding the IT use lifecycle in organisations, as well as the changes made to how the process of appropriation is modelled and described. The value of incorporating a wider view of context

and additional generative mechanisms to create an enhanced MTA for organisations is investigated. The implications of the study methodology for examining technology appropriation are considered including the efficacy of adopting a feature level of analysis, attending to temporality, using methods suited to each generative mechanism, and combining research approaches. Practical implications, a critique of the study and future research are outlined.

1.7 Contributions of the thesis

This thesis makes empirical, conceptual, theoretical, methodological and practical contributions to the IS domain. It represent one of only a few studies that has empirically examined the appropriation process in full, and therefore the whole lifecycle of IT use. It provides refinements and additions to the core concepts associated with the appropriation process, as well as addressing theoretical shortcomings of the MTA. It employs a combined qualitative-quantitative research approach to draw out influences, patterns, and contextual features. The thesis also has practical value, as well as highlighting areas of future research that would further enhance understanding of the appropriation of IT artefacts by users over time.

Chapter 2: The lifecycle of IT use - an appropriation perspective

2.1 Introduction

Understanding and predicting the use of information systems is one of the central concerns for IS researchers and practitioners (Benbasat & Zmud 2003; DeLone & McLean 1992; Karahanna et al. 1999; McLean et al. 2002; Trice & Treacy 1988). A system that is underutilised, misused or avoided altogether does not achieve the intentions of its designers or those who have procured the system. Given its centrality for both researchers and practitioners, it is important to identify the ways in which researchers choose to conceptualise, examine and theorise about use. This is because the particular concepts, phases of use and theories each play a role in influencing what is included or excluded from consideration. If use is conceptualised simply in terms of the extent of use, then qualitative changes in patterns of use are ignored. If only one phase of use is considered, then the dynamics of influences and patterns of use over time cannot be examined. If a theory was not developed in the context of examining the whole lifecycle then its ability to explain the whole would likely be constrained.

The central premise examined in this chapter is that the whole lifecycle of IT use is not well understood, and that the reasons for this relate to the conceptual, methodological and theoretical choices made by researchers. An important corollary of this premise is that understanding the lifecycle as a whole makes additional contributions to IS research and practice than those insights provided by research focussed on only a subset of the lifecycle. Furthermore, an enhanced understanding of the lifecycle assists in identifying the limits of applicability of partial views of the lifecycle.

In this chapter the lifecycle of IT use is described and the variety of concepts employed to describe system use is analysed. Studies that have examined one or more phases of the use lifecycle are reviewed in order to identify influences and patterns of use across the phases of the lifecycle. Theories used to explain use, and the lifecycle of use more broadly, are then discussed and critiqued and a theory for understanding the whole lifecycle identified: the Model of Technology Appropriation (MTA). The MTA is seen to incorporate many of the

strengths of the other models but is somewhat lacking with respect to explaining the how and why of changes in patterns of use over the lifecycle. Additional theories or motors of change are therefore introduced, which could be incorporated with the MTA as a way of addressing this weakness.

2.2 The lifecycle of IT use

The lifecycle of IT use describes the phases through which use of an IT artefact transitions; from the period prior to use through to continued use and/or rejection. How the lifecycle is represented is influenced by the ways in which use is conceptualised. When use is conceptualised as the extent of use, the lifecycle entails pre-use, initial use and continued use (see Figure 2.1). Alternatively, the lifecycle can be understood in terms of the nature of use and includes adaptive use and stabilised use, and related concepts such as appropriation (see Figure 2.2). The diagram in Figure 2.3 combines these two views of how use is represented and explored.

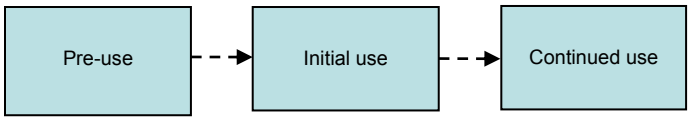


Figure 2.1 The extent of use lifecycle

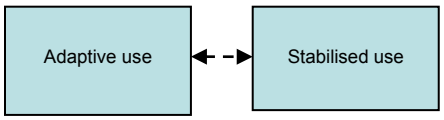


Figure 2.2 The nature of use lifecycle

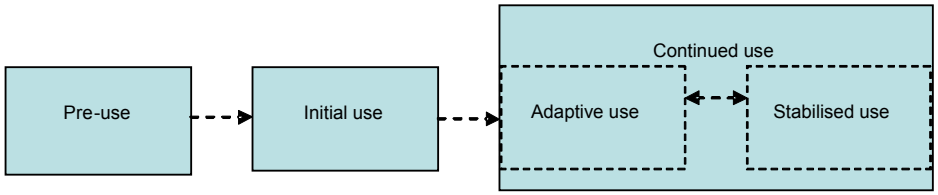


Figure 2.3 The lifecycle of IT use

The lifecycle of IT use (Figure 2.3) begins with pre-use, which represents the period prior to a potential user starting to use a technology to support particular activities and practices (Bhattacherjee & Premkumar 2004). This phase involves the user becoming acquainted with some of the features offered by the technology when first exposed to the technology, or following information about a proposed technology, as might occur via word of mouth, an advertisement, during a demonstration or a presentation. This phase is followed by initial use (Jasperson et al. 2005), during which time the user starts to employ features of the technology to support the conduct of tasks, such as might occur during a training course (Burton-Jones & Straub 2006). Adaptive use occurs as a user engages in a more detailed exploration of the technology through applying the technology to support the conduct of work practices within particular use contexts (Constantinides & Barrett 2006; Desouza et al. 2007; Trigg & Bødker 1994). Adaptations are made to the technology by a particular user to support their specific practices and use context, and adaptations are also made to user practices and the use context in response to the technology (Trigg & Bødker 1994; Tyre & Orlikowski 1994). Stabilisation entails the routinisation of patterns of use (Trigg & Bødker 1994; Tyre & Orlikowski 1994). Routines that develop may change in response to discrepant events or new discoveries by users (represented by the two-way arrow between adaptation and stabilisation in Figure 2.3) (Mendoza et al. 2005; Tyre & Orlikowski 1994). At any time during the use lifecycle users may decide not to employ the particular IT artefact (represented by the dashed arrows) (Bhattacherjee 2001; Carroll 2004; Pollard 2003; Rogers 1995; Wilson & Howcroft 2005). Continued use is an alternative phase to adaptation and stabilisation when the nature of use is not explored. It is a the period of use that follows initial or first use (Hsieh et al. 2008; Karahanna et al. 1999; Pollard 2003; Rogers 1995; Shih 2008; Venkatesh et al. 2003).

In this section, the variety of ways in which use has been conceptualised is considered in detail, categorised from the perspective of the extent or the nature of use. Attention then turns to studies that have explored one or more phases of the lifecycle, including consideration of influences on use and patterns of use over time.

2.2.1 Conceptualising the lifecycle

The use of IT artefacts has been conceptualised in a variety of ways. A useful way of distinguishing between different conceptualisations is to categorise them according to their focus on the either the extent or nature of use (Burton-Jones & Straub 2006). The extent of

use is commonly assessed via self-report measures of the frequency or amount of use. Use is framed as a thing that changes in value but not in identity or character. By contrast, the nature of use is viewed as potentially taking qualitatively different forms such as adaptation, stabilisation and appropriation and is often identified using qualitative methods (Carroll 2004).

2.2.1.1 Extent of use: pre-use, initial use and continued use

Researchers interested in the extent of use have focussed on pre-use, initial use and/or continued use and have tended to adopt quantitative survey-based research approaches. Attention is given to pre-use in situations where use is not well established, such as for new or prototype systems. In particular, researchers have attempted to predict future use by assessing users' intentions to engage in system use (behavioural intention) (Agarwal & Prasad 1998; Davis et al. 1989; Karahanna et al. 1999; Mathieson 1991; Taylor & Todd 1995b). In assessing initial and continued use, researchers have commonly measured frequency of use and time spent using the system (Adams et al. 1992; Al-Gahtani & King 1999; Davis 1989; Davis et al. 1989; Hubona & Geitz 1997; Igbaria 1990; Igbaria et al. 1989; Igbaria et al. 1997; Raymond 1985; Roberts & Henderson 2000). To a lesser extent researchers have used hardware (DeLone & McLean 1992) and software (Venkatesh et al. 2003) monitors to record actual system use.

2.2.1.2 Nature of use: adaptive and stabilised use

Researchers concerned with examining the nature of use have been interested in adaptive and stabilised use, primarily drawing on qualitative research approaches, although quantitative approaches are also employed. The idea of adaptive use captures a range of concepts focussed on:

- adaptations to the technology itself such as personalization (Desouza et al. 2007), customization (Desouza et al. 2007; Mackay 1990a; Trigg & Bødker 1994), inventions (Desouza et al. 2007), reinvention (Johnson & Rice 1984) (Rice & Rogers 1980; Rogers 1995), extended and exploratory use (Saeed & Abdinnour-Helm 2008), as well as tailoring (Trigg & Bødker 1994);
- adaptations to work practices following system implementation (Chu & Robey 2008), work-arounds and improvisation (Hayes 1999); as well as
- mutual changes in the technology and associated practices and use context through such concepts as adaptation (Tyre & Orlikowski 1994; Wu & Ho 2005), mutual adaptation

(Boersma & Kingma 2005; Carroll 2004; Leonard-Barton 1988; Majchrzak et al. 2000), mutual adjustment (Rose & Jones 2005) enactment, emergent use (Orlikowski 2000), co-adaptation (Mackay 1990b), co-evolution (Kim & Kaplan 2006), structuring (Barley 1986; DeSanctis & Poole 1994), nature of IS use (Jain & Kanungo 2005), IS use-related activity, which includes task-technology adaptation and individual adaptation (Barki et al. 2007), and the process of appropriation (Carroll 2004; Mendoza et al. 2008).

Whilst many of these researchers emphasise technology adaptations, they also have reported that these adaptations are not ongoing. Over time, adaptations become stabilised (Mendoza et al. 2008; Nord & Tucker 1987; Wilson & Howcroft 2005), structured, systematised (Trigg & Bødker, 1994), routinised (Cooper & Zmud 1990; Orlikowski 1992; Rogers 1995; Sundaram et al. 2007; Tyre & Orlikowski 1994), integrated, appropriated (Carroll 2004), infused (Sundaram et al. 2007), embedded (Baxter & Berente 2010), taken for granted or institutionalised (Orlikowski 1992) within particular use contexts. The use of systems becomes habitual (Limayem & Hirt 2003) and automatic (Kim et al. 2005), shifting from exploration to exploitation (Burton-Jones & Straub 2006; March 1991). This is not meant to imply that achieving such a steady state is permanent. Adaptations can again occur in response to changes in the user, the technology or the use context (Tyre & Orlikowski 1994).

What these concepts have in common is the idea that technology use is not static, it evolves and then stabilises. In addition, the system itself is viewed as embodying a certain potential to be adapted using such terms and phrases as interpretive flexibility (Azad & King 2008; Doherty et al. 2006; Law & Bijker 1992; Orlikowski 1992), malleability (Kallinikos 2002), and tailorability (MacLean et al. 1990; Wulf et al. 2005).

2.2.2 Examining the lifecycle

In this section, the focus is on a sample of research studies (see Table 2.1) that consider one or more phases of the IT use lifecycle, augmented by published reviews of the literature (Diez & McIntosh 2009; Jeyaraj et al. 2006). These studies are examined to demonstrate the extent of coverage of the use lifecycle (see Table 2.1). They are analysed to identify influences and patterns of use at different phases of the lifecycle.

	Phase of the IT use lifecycle				
Single phase	**Pre-use**	**Initial use**	**Adaptive use**	**Stabilised use**	***Continued use***
Agarwal and Prasad (1998)	✓				
Bhattacherjee (1998)		✓			
Burton-Jones and Straub (2006)		✓			
Davis (1989)		✓			✓
Leonard-Barton (1988)			✓		
Desouza et al.(2007)			✓		
Mackay (1990a)			✓		
Hayes (1999)			✓		
Orlikowski (2000)			✓		
Kim et al. (2005)				✓	
Limayem and Hirt (2003)				✓	✓
Igbaria et al. (1989)					✓
Igbaria and Tan (1997)					✓
Adams et al. (1992)					✓
Clegg et al. (1997)					✓
Al-Gahtani and King (Al-Gahtani & King 1999)					✓
Lee (1986)					✓
Igbaria, 1990 (1990)					✓
Igbaria et al. 1995 (1995)					✓
Compeau et al. (1999)					✓
Thompson et al. (1989)					✓
Roberts and Henderson (2000)					✓
Straub et al. (1995)					✓
Two phase					
Karahanna et al. (1999)	✓				✓
Taylor and Todd (1995a; 1995b)	✓				✓
Davis et al. (1989)		✓			✓
Venkatesh (2003)		✓			✓
Majchrzak et al. (2000)	✓		✓		
Chu and Robey (2008)	✓		✓		
Santhanam et al.(2007)		✓	✓		
Jain and Kanungo (2005)			✓	✓	✓
Tyre and Orlikowski (1994)			✓	✓	
Orlikowski (1992)			✓	✓	
Azad and King (2008)			✓	✓	
Kim and Kaplan (2006)			✓	✓	
DeSanctis et al.(2000)			✓	✓	
Johnson and Rice (1984)			✓	✓	
Trigg and Bødker(1994)			✓	✓	
Three phase					
Carroll et al. (2003a)	✓	✓	✓		
The whole lifecycle					
Mendoza et al. (2005)	✓	✓	✓	✓	
Mendoza et al. (2008)	✓	✓	✓	✓	

Table 2.1 Categorisation of studies of technology use by lifecycle phase

Table 2.1, together with published literature reviews (Diez & McIntosh 2009; Jeyaraj et al. 2006), shows that very few researchers have investigated use over all four phases of the use lifecycle, or even over three phases. The majority of research on the use of IT artefacts only provides a partial view of use across the lifecycle, and influences on use over time. This

research does provide insights into influences on use and patterns of use at different phases, however, the understanding derived from each phase cannot simply be combined together in order to generate understanding of the whole lifecycle. Part of the reason for this is the particular concepts, theories and associated research approaches employed across studies are not necessarily readily combined. Furthermore, whilst aggregating findings across studies points to broad themes and issues (see next section), it does so at the expense of context. In addition, there is the danger that combining the parts may lead to a distorted view of the phenomenon of interest. In the parable of the blind men and the elephant, each blind man believed they were describing a different phenomenon, but were unable to recognise the elephant as their perspectives were overly constrained. The other side of this is that by understanding the whole, the meaning of the parts can become clearer. For example, one blind man's 'pillar' was the foot of the elephant, or continued use is not just use that occurs following pre and initial use, but also entails adaptive and stabilised use. Examining the whole lifecycle of IT use may therefore facilitate improved insights into transitions between phases and associated changes in influences over time, as well as enhancing theory.

Consideration will now be given to influences that operate at each of the phases of the lifecycle and to the nature and extent of changes in influences on system use over time.

2.2.2.1 Influences on use across phases

Studies that have examined the pre-use phase have commonly found that perceived usefulness (including relative advantage and expectations of positive outcomes) is an important positive influence on future use intentions, as is subjective norms (including normative pressures)(e.g. Mendoza et al. 2005; Taylor & Todd 1995a)(see Appendix A for a summary of influences on technology use for the papers listed in Table 2.1) Perceived usefulness continues to be a strong determinant of intentions in the initial use phase, following limited use of a system (e.g. Davis 1989; Davis et al. 1989; Venkatesh et al. 2003). It also appears to play a role in encouraging initial use and adaptations to the technology and work practices, alongside of perceptions of system adaptability (Carroll et al. 2003a; Mendoza et al. 2005). The role of perceived usefulness and adaptability in encouraging adaptation in the technology or practices is sustained somewhat with greater system exposure, noting that such adaptations may entail limiting use by working around a system (Carroll et al. 2003a; Desouza et al. 2007; Jain & Kanungo 2005; Mendoza et al. 2005; Orlikowski 1992; Orlikowski 2000). Discrepant events are also important determinants of adaptation (Majchrzak et al. 2000; Tyre & Orlikowski

1994) as are various misalignments (Leonard-Barton 1988; Majchrzak et al. 2000). Only seven of the 11 studies that described stabilisation identified influences on stabilisation. Usefulness or the related construct of IS-enable productivity, as well as ease of use, were identified in three studies. In the two studies by Mendoza et al. (2005, 2008) a lack of ease of use was implicated as a reason for no further adaptation occurring. Other influences of note were past use (Kim et al. 2005) and the similar concept of habitual behaviours (Tyre & Orlikowski 1994). Whilst these particular influences are under-researched in IS, they are consistent with psychological research showing that one of the strongest predictors of current behaviour is prior behaviour (Janis & Nock 2008; Jasperson et al. 2005; Ouellette & Wood 1998; Webb & Sheeran 2006).

The largest sub-group of papers considered in this review investigated influences on use at the continued use phase. Perceived usefulness and related measures (relative advantage, perceived consequences, outcome expectations, IS enabled productivity, individual impact and job fit) were particularly prominent influences on continued use, with 14 of the 19 studies finding a significant relationship. Ten studies identified significant relationships between various measures of facilitating conditions (including training (4), system support (2), organisational support (3) and a combined measure (1)) and use. This was followed by perceived ease of use and associated usability measures (system quality, usability, rating of system design) (8 studies), although the strength of relationships found was only weak to moderate, with its effect on use mediated via usefulness in some studies (e.g. Davis et al. 1989). Three studies found a significant link between behavioural intentions and use (Davis et al. 1989; Limayem & Hirt 2003; Taylor & Todd 1995b). Prior computer experience and subjective norms (social environment) were also identified as significant influences on use in two studies (Igbaria et al. 1995; Limayem & Hirt 2003; Taylor & Todd 1995b). In a comprehensive review of factors that influence use of information systems, Diez and McIntosh (2009) identified all of the above influences, except ease of use, as the best predictors of adoption and use at the implementation stage of the IS lifecycle (pre-implementation, implementation, post-implementation). A review by Jeyaraj et al. (2006), which combined quantitative and qualitative studies, similarly found perceived usefulness, facilitating conditions (top management support and user support), computer experience and behavioural intention as the best predictors of individual IT adoption.

2.2.2.2 Changes in influences on use over time

A review of prominent influences identified at each phase of the lifecycle (see Appendix A) shows that influences on adoption intentions and use do change over time, perhaps with the exception of perceived usefulness. Subjective norms and perceived usefulness both play a role prior to use, however the influence of subjective norms following use is diminished compared with perceived usefulness. Perceived usefulness not only shapes intentions, it also encourages initial and continued use as well as being implicated in adaptation and stabilisation of use patterns. However, there are other influences that emerge as users explore and use technologies in context. The adaptability of the system itself, and the occurrence of discrepant events both influence users in engaging in adaptations to the system and/or associated work practices. As use of systems stabilises, additional influences emerge in the form of past use and habitual behaviours. This general pattern of influences on use at each phase of the lifecycle was supported by a review of those papers that examined changes in influences over time (Bhattacherjee & Premkumar 2004; Carroll et al. 2003a; Chu & Robey 2008; Cooper & Zmud 1990; Jasperson et al. 2005; Karahanna et al. 1999; Majchrzak et al. 2000; Mendoza et al. 2005, 2008; Tyre & Orlikowski 1994; Venkatesh et al. 2003). For example, Karahanna et al. (1999) found that intentions to adopt were influenced by normative pressures (related to subjective norms), where as intentions to use were determined by attitudes (including usefulness).

2.2.2.3 Changes in patterns of use over time

At the pre-use phase, studies have investigated intentions or decisions to use a system in the future (see table in Appendix A, column "outcomes influenced"). Intentions have also been investigated at the initial use phase (Davis 1989; Davis et al. 1989; Venkatesh et al. 2003). However, with initial use comes the opportunity to undertake a preliminary examination of the extent of use (Bhattacherjee 1998), as well as the nature of use, including adaptations and customisations to the system, and adaptations to practices (Carroll et al. 2003a; Mendoza et al. 2005, 2008). Intentions have also been examined at the continued use phase (Davis et al. 1989; Karahanna et al. 1999; Limayem & Hirt 2003; Taylor & Todd 1995b), although the value of assessing intentions, instead of use, once the behaviour in question has become manifest is problematic (Kuo & Young 2008; Rogers 1995). More prominent are studies examining the extent of use, with the frequency and amount of use particularly common (Adams et al. 1992; Davis 1989; Jain & Kanungo 2005; Limayem & Hirt 2003). To a lesser extent, the number of applications employed or the number of tasks supported are also

assessed (e.g. Igbaria et al. 1995), as are changes in the extent of use over time (van den Hooff 2005). The types of phenomena considered at the adaptive use phase broadly include adaptations to the technology itself, adaptations to work practices, or both (Chu & Robey 2008; Desouza et al. 2007; Leonard-Barton 1988). Likewise, the stabilisation phase is characterised using a variety of concepts, such as routinisation (Tyre & Orlikowski 1994) (see Appendix A for the full listing of studies for each phase).

Examining changes in patterns identified within particular studies shows that intentions to adopt have some influence on subsequent use (Davis et al. 1989; Limayem & Hirt 2003; Taylor & Todd 1995b), although the strength of this relationship is undermined in those studies where only survey methods are employed due to common method variance effects (Sharma & Yetton 2001; Sharma et al. 2009). Studies that have examined use in context in detail show that potential users positive initial impressions do not necessarily translate into continued or effective use, in some cases leading to minimal use or outright rejection (Mendoza et al. 2005, 2008). Alongside of continued use, users engage in various forms of adaptation, with use patterns stabilising over time, although such stabilisations are not permanent, with adaptations again occurring (Tyre & Orlikowski 1994).

In this section, a wide range of influences on use at different phases of the lifecycle were identified, however some are more prominent that others, such as perceived usefulness. Influences on use and patterns of use at different phases of the lifecycle were found to change over time.

2.3 Theories to explain the lifecycle

There is a large number of candidate theories used in describing, explaining or predicting one or more aspects of the IT use lifecycle. The theories discussed below have been selected based on their alignment with one or more of the key concepts and phases associated with the lifecycle, but also based on their prominence within the IS research community.

2.3.1 Technology acceptance

The theoretical grounding for much of the research into user acceptance of IT comes from the technology acceptance model (TAM) developed by Davis et al. (1989). This model is an

adaptation of the theory of reasoned action (TRA), which sees beliefs and attitudes as antecedents of future behavioural responses, such as actual system use (Ajzen 1985; Davis 1993). TAM differs from the TRA by identifying the role of external variables more explicitly and by identifying two particular belief constructs as particularly relevant in the IS domain, perceived usefulness and perceived ease of use. These beliefs either directly or indirectly, via attitudes towards using the technology, are seen to shape users intentions to employ a system, which in turn determines system use, which is usually conceptualised as the extent of use (Davis 1989; Davis et al. 1989). Figure 2.4 presents TAM as represented by Davis et al. (1989, p. 985).

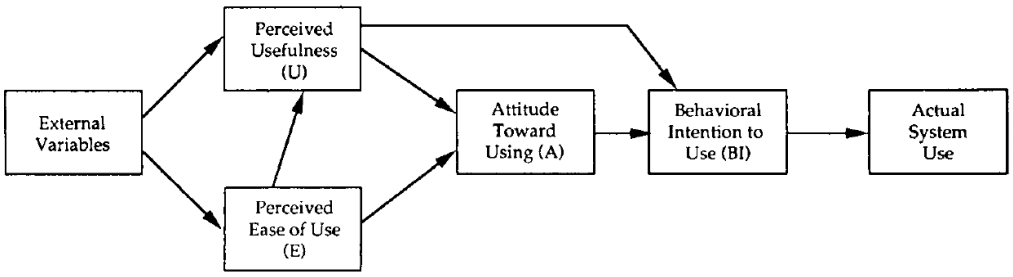


Figure 2.4 The technology acceptance model (Davis et al. 1989)

The research by Davis and colleagues (1989; 1989) on technology acceptance and its antecedents (perceived usefulness and ease of use) has had, and continues to have, an enormous influence on IS research. This is a positive in the sense that it has laid the foundation for a cumulative tradition whereby there has been widespread and persistent use of the two key variables, perceived ease of use and usefulness, in a diverse range of use contexts and technologies. In addition, the statistical methods employed in these numerous studies, such as regression analysis and structural equation modelling, to test hypothesised links between these variables and use afford researchers statistical control that can be construed as a form of experimentation (Lee 1999). This can assist in cutting through the complexity of the phenomena of interest. However, the parsimony of TAM, and its apparent power in explaining a fair portion of the variance, appears to have led to too much attention being placed on the extent of variance explained rather than the untidy and messy unexplained variance. A focus on pre-specified variables and the explained variance in models such as TAM leads to a neglect of context, which removes the capacity to understand the "subtle nuances of interaction that are critical in apprehending what is really occurring" (Pfeffer 1982, p. 75). As a result, whilst levels of perceived usefulness and ease of use would assist

managers with understanding influences on intentions and use in a general sense, the information provided would say little about the specific contextual factors operating on users of the particular technology.

TAM, and associated acceptance models such as the Unified Theory of Acceptance and Use of Technology (UTAUT)(Venkatesh et al. 2003), are cognitive-rational theories that assume system use is driven by the intentionality of users, with users' intentions being informed by their beliefs and attitudes toward the technology of interest (Pfeffer 1982). To the extent that behaviour is driven by intention then such models have some utility. However, this class of theories have been widely criticised in the social and management sciences more broadly (Abraham & Sheeran 2004; Louis & Sutton 1991; Ogden 2003; Pfeffer 1982). Such theories have been criticised for

- not helping to explain the variety of things people do, such as the range of features employed on a system, versus just explaining a particular behaviour of interest, such as extent of system use (Abraham & Sheeran 2004).
- Creating and shaping rather than describing users' cognitions and behaviours (Ogden 2003; Pfeffer 1982; Taylor & Todd 1995b)
- Assuming unidirectional causality and the associated implication that beliefs and attitudes come before behaviour, despite evidence that behaviour also shapes attitudes and beliefs (Mintzberg & Westley 2001; Pfeffer 1982). People are not always consciously engaged before taking action, but instead act habitually (Louis & Sutton 1991).
- Relying on statistical inference, which provides a weak explanation as to why the relationships identified are significant (Hovorka et al. 2008; Pfeffer 1982).

Another limitation of user acceptance models like TAM and UTAUT is that time is viewed as part of the background (Van de Ven & Poole 2005). The amount of time is uncritically applied as an indicator of experience, familiarity and routinisation (Venkatesh et al. 2003), or the interest in time is limited to providing distance between two measurements so as to determine the strength of the causal relationship between behavioural intention and system use (e.g. Davis 1989; Taylor & Todd 1995b). This and the above limitations raise serious questions about the utility of TAM and related models for understanding the lifecycle of use. Nevertheless, such models can assist in drawing inferences about the salience and strength of particular influences on intentions and use, which may be particularly relevant at the pre-use

and initial use phases when users might be expected to be more driven by intentions (Venkatesh et al. 2003).

2.3.2 Diffusion of innovation

The literature on the diffusion of innovations is diverse, and populated by a variety of different models that address individual and organisational decision points and activities (Cooper & Zmud 1990; Hage & Aiken 1970; Johnson & Rice 1984; King 1990; Kwon & Zmud 1987; Rice & Rogers 1980; Rogers 1995; Wolfe 1994). However, Everett Rogers has dominated research into the diffusion of innovations. In his book "Diffusion of innovations" (Rogers 1995), Rogers presents a model (p. 163) that describes individuals moving through five stages (see Figure 2.5):

- Knowledge: the stage where a potential adopter becomes aware of an innovation and develops some understanding of its capabilities.
- Persuasion: the stage where the formation of either positive or negative attitudes towards an innovation occurs.
- Decision: the stage where a person decides either to adopt or reject an innovation.
- Implementation: the stage where a person puts an innovation to use.
- Confirmation: the stage where the innovation-decision is either reinforced or an earlier decision to adopt or reject a system is reversed.

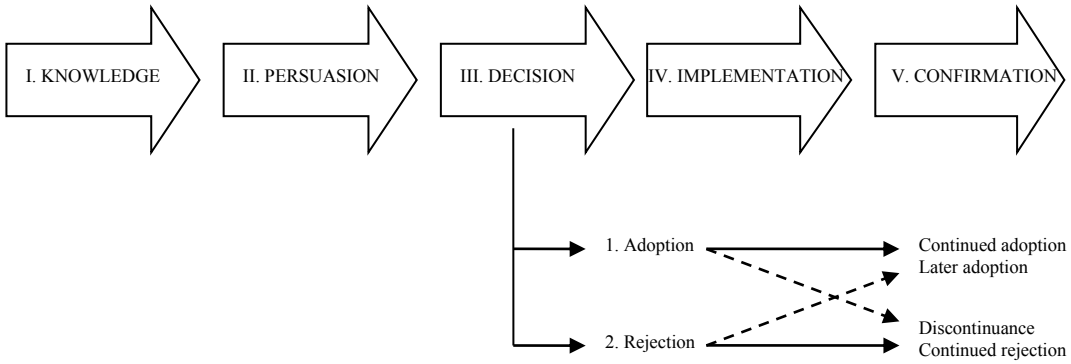


Figure 2.5 Model of the innovation-decision process (Rogers 1995)

In addition to these stages, Rogers also identifies five key attributes of innovations that influence user adoption at the persuasion stage.

- Relative advantage: the extent to which an innovation is viewed as better than its predecessor.
- Compatibility: the extent to which an innovation is viewed as consistent with the extant needs, values, beliefs and experiences of potential adopters.
- Complexity: the extent to which an innovation is viewed as difficult to use.
- Observability: the extent to which the impacts of an innovation are visible to others.
- Trialability: the extent to which an innovation can be experimented with prior to the adoption decision.

The model and attributes have been employed extensively in the IS literature (e.g. Agarwal & Prasad 1998; Hsiu-Fen & Gwo-Guang 2006; Karahanna et al. 1999; Kautz & Larsen 2000; Kraut et al. 1998; Moore & Benbasat 1991; Pollard 2003; Prescott & Conger 1995; Rice & Rogers 1980; Shih 2008). They assist in examining influences prior to, during and after the adoption decision. Furthermore, the model draws a distinction between initial use, when the innovation is put to use (implementation stage), and continued/discontinued use (confirmation stage) (Pollard 2003).

Models of the innovation adoption and diffusion process (Carayannis & Turner 2006; Cooper & Zmud 1990; Hage & Aiken 1970; Johnson & Rice 1984; Kwon & Zmud 1987; Nord & Tucker 1987; Saga & Zmud 1994), are lifecycle models. As such change is explained by reference to the sequence of phases through which the system of interest passes (Van de Ven & Poole 1995). However, such lifecycle models tell us little about the underpinning mechanisms that generate the behaviour observed.

There are two additional criticisms of the innovation diffusion literature. Historian David Edgerton argues that views of innovation tend to be centred on innovations as they are emerging not after they have long been in use “Even as new technologies revolutionize everything from health care to media to warfare, it’s important to remember that our world runs primarily on products and technologies long in use” (Baker 2007, online). Rogers (1995) also criticizes innovation research for having a strong pro-innovation bias, going on to say that “investigation of rejection behavior of all kinds has not received much scientific attention" (p. 172).

Diffusion of innovation research provides a basis upon which to investigate the lifecycle of use, however, it does so from a perspective that privileges the new over the taken-for-granted and adoption over rejection.

2.3.3 Structuration

IS researchers have used Giddens' structuration theory (1986), to explain the interactions between technology and people embedded in social contexts such as organisations (Jones & Karsten 2008). Giddens was concerned with transcending the dichotomous logic associated with dominant traditions within social theory that privileged either the agency of individuals or the structures that limit human choices and action, such as properties of society. Structuration theory seeks to reconcile tensions between individual and societal level explanations of social phenomena through seeing both as being mutually constituted (Jones & Karsten 2008). Social phenomena are the product of both structure and agency: "human agents draw on social structures in their actions, and at the same time these actions serve to produce and reproduce social structure" (Jones & Karsten 2008, p. 129). These structures, or more particularly the structural properties of social systems, consist of rules and resources used by individuals in their interactions. "These rules and resources mediate human action, while at the same time they are reaffirmed through being used by human actors" (Orlikowski 1992, p. 404).

One appeal of this theory for IS researchers is that it provides a means of adopting a non-dichotomous logic (Pozzebon 2004). For IS researchers adopting a structurational perspective, the structure/agency dichotomy is overcome by framing the relationship between technology and humans as the process through which humans shape and are shaped by IT artefacts (Orlikowski 1992; Poole & DeSanctis 1990). Two influential translations of Giddens' theory within IS are Orlikowski's structurational model of technology (Orlikowski 1992), and Poole and DeSanctis' adaptive structuration theory (Poole & DeSanctis 1990).

In the structurational model of technology (SMOT), Orlikowski (1992) argues that technology is created and changed by human action, yet it is also used by humans to accomplish some action, which Orlikowski calls 'the duality of technology' (p.405). Furthermore, 'technology is interpretively flexible': to varying degrees "users of a technology are engaged in its constitution (physically and/or socially) during development or use" (Orlikowski 1992, p.

409). Technology is therefore interpreted and constituted in different ways by different users (Bijker & Law 1992). The perspective offered by Orlikowski recognizes the material constraints imposed by the original design of an IT artefact but highlights the importance of considering the process through which a particular artefact comes to be embedded or institutionalised within a particular context. However, SMOT is not fine grained enough in its treatment of IT artefacts, and as a consequence it is not readily able to inform changes to system design or associated practices (Chae & Poole 2005; Monteiro & Hanseth 1995). Poole and DeSanctis, in developing the adaptive structuration theory, avoid this shortcoming as they examine the appropriation of systems at a microlevel of analysis.

Adaptive structuration theory (AST) emerged out of research which studied appropriation to understand underlying social interactions and processes associated with the use of group decision support systems (DeSanctis & Poole 1994; Poole & DeSanctis 1990). Appropriation is here understood to be ”the immediate, visible actions that evidence deeper structuration processes" (p. 128). Users are able to appropriate the structural features or capabilities of a system in a wide variety of ways (DeSanctis & Poole 1994). Structural features represent particular capabilities, or rules and resources, provided by the system. Structural features "govern exactly how information can be gathered, manipulated, and otherwise managed by users" (p. 126). Underlying these structural features is the way in which users should act when employing the system, referred to as the spirit. The spirit of a technology reflects, amongst other things, the designers’ intentions. However, the ways in which users appropriate or implement the technology are not determined by the technology design.

One of the concerns about AST, as well as SMOT, is its view of technology as encapsulating social structures in the form of structural features and spirit. This view runs counter to the position adopted by Giddens, who argued that social structures do not exist independent from the action of humans (Markus & Silver 2008). A further concern is the apparent anthropomorphism of the spirit concept, which is described as somehow conveying or embodying the designers’ intentions (Markus & Silver 2008). AST also appears to have been predominantly applied to group or collaborative information systems such as group decision support systems and computer mediated communication (Jones & Karsten 2008), rather than less socially mediated systems.

A more general critique of structurational approaches are difficulties experienced by readers in readily apprehending the meaning of the text. IS is an applied discipline and it has been argued that the accessibility of theories is an important consideration in judging relevance (Rosemann & Vessey 2008). Structuration theory, AST and SMOT are frequently difficult to apprehend, and employ concepts that bear little relation to their more common forms of use. For example, Giddens' definition of structure, defined in terms of rules and resources, is particularly idiosyncratic (Jones & Karsten 2008).

2.3.4 Adaptation

A number of additional theories and models to those described above in sections 2.3.2 and 2.3.3 have focussed on describing and explaining adaptations to technology, the wider context or both (Azad & King 2008; Desouza et al. 2007; Johnson & Rice 1984; Kim & Kaplan 2006; Leonard-Barton 1988; Majchrzak et al. 2000; Orlikowski 2000; Trigg & Bødker 1994; Tyre & Orlikowski 1994). Here attention is given to two empirical research papers of particular note that focus on mutual adaptation (Leonard-Barton 1988) (Tyre & Orlikowski 1994).

Leonard-Barton (1988) developed a model of mutual adaptation between technology and the user environment (see Figure 2.6). The model is intended to present some broad concepts that are believed to describe the process of initial technology implementation, principally misalignments and cycles. Technology and the user environment are initially out of alignment, but over time they are brought into alignment resulting in implementation success. The presence of misalignments is viewed as the reason for adaptations occurring. A perfect match would mean that no adaptations to the work environment were necessary. Leonard-Barton describes three forms of misalignments: technical misalignments –the technology with the associated process or the original specifications; delivery system misalignments – the technology with the organisation infrastructure (hardware, software, training etc); and performance criteria misalignments – the technology with the perceived impact and significance of system for users work activities. Another feature of the model is the presence of both small and large cycles of adaptation to the technology or to the user environment. Adaptations are described as cyclical "because the process is one of circling back to revisit a decision point" (p. 260) - whether it be to re-examine the system design, re-design the delivery system or unfreeze organisational routines.

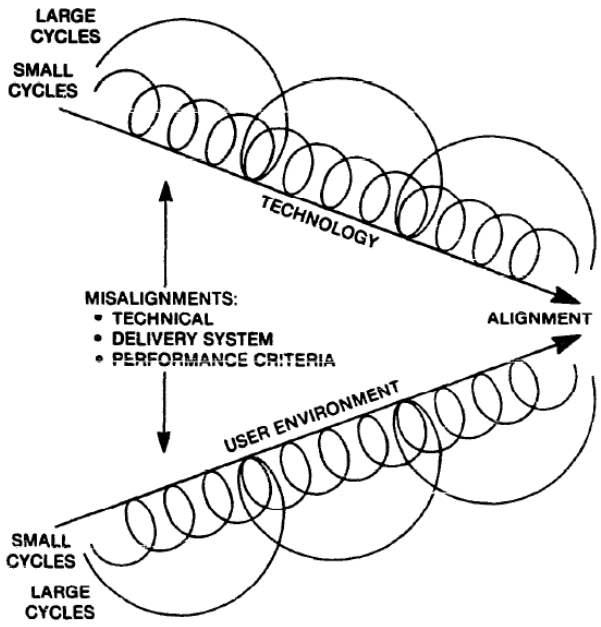


Figure 2.6 Mutual adaptation of technology and organisation (Leonard-Barton 1988)

This model is useful in highlighting the active role played by users in adapting technologies even after they have been introduced. It also describes classes of influences or misalignments that serve to provide the impetus for adaptation. There are however issues with the model. The model assumes that over time movement toward alignment occurs. But other research suggests that technology and user environments can again fall out of alignment leading to renewed adaptation (Mendoza et al. 2005, 2008; Tyre & Orlikowski 1994). The model fails to convey the possible rejection of technologies resulting from efforts to bring them into alignment with user environments. The model also places adaptation in the foreground, even though the description of cycles of adaptation entails both adaptation and stabilisation.

Tyre and Orlikowki (1994) developed a descriptive model of patterns of technology adaptation in organisations over time (p.114) (see Figure 2.7). This model was developed from three cases, with each case including a number of different technologies and groups. Despite this diversity, the researchers consistently found that the process of adaptation was discontinuous or episodic with periods of adaptation followed by periods of routine use (see Figure 2.7). The initial period of adaptation involved exploration of the new technology in the context of use and was the period during which most adaptation occurred. The extent of adaptation quickly diminished with use becoming routine. Movement towards routinisation was influenced by: production pressures taking resources away from being able to continue to adapt; users quickly adapting themselves to the technologies and transitioning to habits and

routines; adjustment of expectations to better align with the actual capabilities of the system; and erosion of team membership and enthusiasm. Subsequent adaptations to technologies or to users' work contexts were triggered by discrepant events or new discoveries by users, which again encouraged users to reflect on their work practices and to make resources available to solve problems.

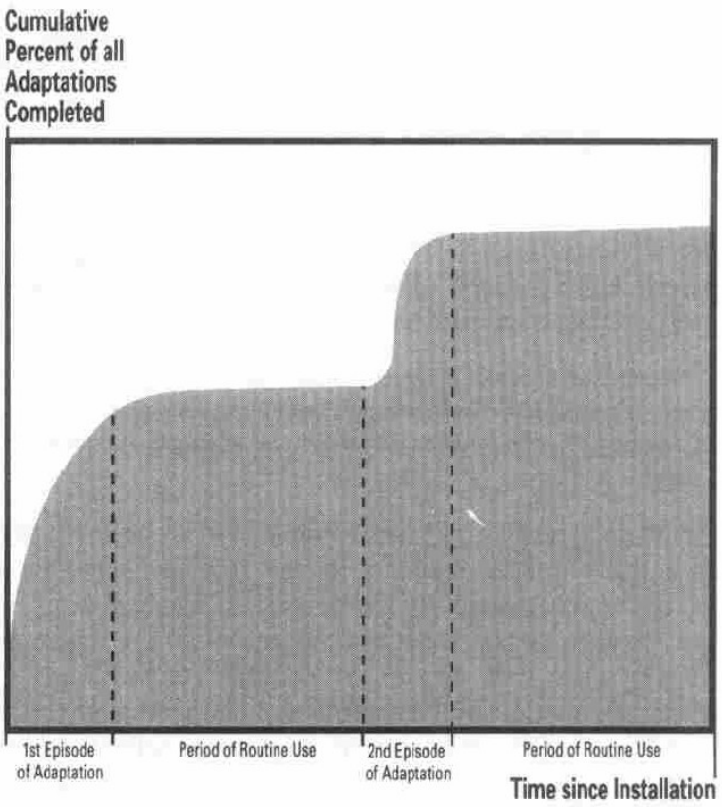


Figure 2.7 Relationship between time and adaptation of technology (Tyre & Orlikowski 1994)

One of the strengths of this work is the development of a model that emerged from an analysis of the dynamics of technology adaptation. The findings run counter to assumptions in some of the innovation literature of more gradual and continuous change over time (Tyre & Orlikowski 1994). The model also has some explanatory power by identifying influences that both constrain and enable adaptation. However, it does not explicate the generative mechanisms that underlie the dynamics they describe, although it does have the flavour of evolutionary theory by highlighting the role played by triggers in restarting adaptation and emphasising the constraints imposed on adaptation by limited resources.

2.3.5 Model of Technology Appropriation (MTA)

The Model of Technology Appropriation (MTA) represents the process of appropriation through which technology is evaluated by people over time and adopted, adapted and incorporated into their everyday practices (Figure 2.8) (Carroll et al. 2002a; Carroll et al. 2001).

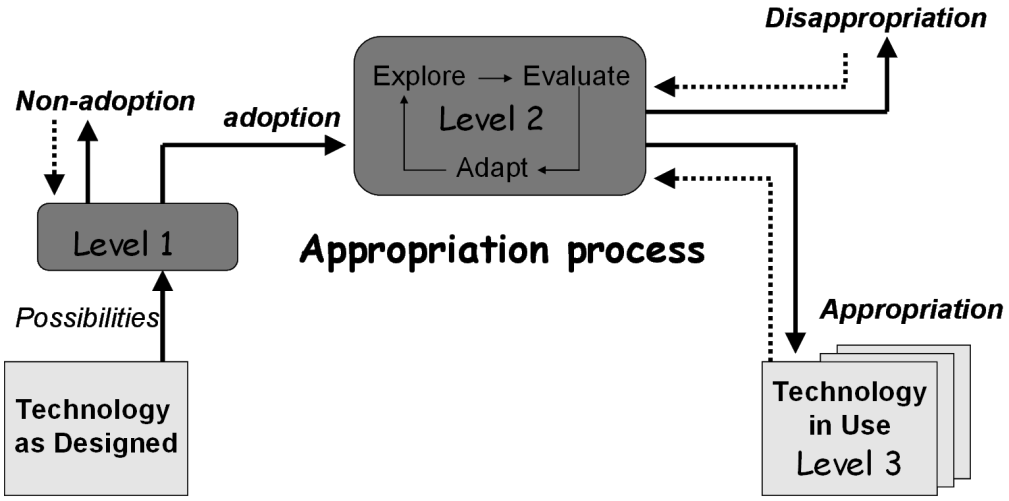


Figure 2.8 The model of technology appropriation (Carroll 2004)

The MTA is a generic model of technology appropriation that can be contextualised for particular technologies and user cohorts (Carroll 2004). It has been used to describe the appropriation of mobile phones, bibliographic software, Short Messaging Service, e-mail, customer relationship management software, open source software and a learning management system (Carroll et al. 2002c; Carroll et al. 2003b; Herszfeld et al. 2003; Heung 2002; Mendoza et al. 2005; Mendoza et al. 2007; Nor Zairah & Rose Alinda 2007).Throughout the process of appropriation various influences shape the beliefs, attitudes and behaviours of users toward the technology.

The model represents three levels of evaluation that correspond to different phases of the appropriation process (Carroll et al. 2002a). The first phase covers initial exposure to a technology, the second phase to adaptation, and the final phase to stabilisation or incorporation. When first encountering a technology a user is confronted with the technology as intended by its designer, or 'technology as designed', which "has features, capabilities and an underlying theory or spirit" about how the technology should be employed (p. 3). From the user's perspective the technology presents a variety of possibilities for addressing her particular concerns, which may or may not align with those identified by the designers. A

series of influences shape evaluations and the decision whether or not to adopt the technology. In the case of an IS, influences might include expected usefulness and adaptability (Carroll et al. 2003a). The outcome of this level 1 evaluation is the establishment of certain expectations about what the technology can deliver, which leads to either non-adoption or the user choosing to persist with exploring the technology thereby continuing the appropriation process. In the case where the user chooses not to adopt the technology there may be circumstances that cause re-evaluation of the technology at some later time (represented by the dashed arrow from Non-adoption to Level 1 in Figure 2.8).

At the next phase of the appropriation process a user evaluates the technology more deeply through exploring and using the technology (Level 2 evaluation) (Carroll 2004; Herszfeld et al. 2003). A user learns how the technology can support her practices through drawing on particular functionality. In so doing, she may adapt practices associated with the technology as well as adapting the technology itself. During this adaptation phase, there are a variety of influences that serve to encourage or discourage continued appropriation, for example, the extent to which the technology provides valued functionality (Carroll et al. 2003a).

In the final phase a state of appropriation or stabilisation is reached, whereby the practices around the use of the technology become routine, and no further adaptations to the technology occur (Carroll 2004). The technology becomes integrated with work practices, is part of a user's taken-for-granted experience of work, and is just another part of the work landscape, referred to as 'technology in use'. It is during this phase that the design can be said to be fixed, although this may not be permanent (Mendoza et al. 2005)(see dotted arrow back to level 2). The state of appropriation is maintained as long as a user's ongoing evaluation of the 'technology in use' continues to reinforce persistent use. The particular patterns of use are assumed to vary across individuals, conveyed by the multiple tiled boxes associated with 'technology in use' in Figure 2.8. These level 3 evaluations are shaped by various influences, for example, the attitudes and behaviours of one's peer group toward the technology or the performance of the technology. However, users' persistent use and ongoing incorporation of the technology with their work practices is subject to modification if their evaluation of the technology changes. If this occurs then users may return to level 2 and the technology could be disappropriated or rejected.

Whilst not within the scope of this thesis, the MTA clearly has implications for IS development (Carroll, 2004). The 'technology as designed' is the technology as presented to users following its development. How this technology is presented will influence the process of appropriation. The understanding of appropriation provided by the model also has implications for the design, development and selection of IT artefacts over time (Carroll, 2004).

The two primary strengths of the MTA are that it covers the lifecycle from pre-use through to stabilised use, and it is a readily accessible and quite parsimonious model. It also explicitly distinguishes between adaptation and stabilisation (although the later is referred to, somewhat confusingly, as appropriation), as well as incorporating the adoption decision and the possibility of technology rejection occurring after a period of use. In addition, the model highlights the role of influences in shaping user's evaluations and associated patterns of appropriations throughout the process of appropriation; although, due to the generic nature of the model, these influences are not specified and are assumed to vary across technologies and cohorts (Carroll 2004). Nevertheless, in describing the model, Carroll (2004) argues that the features of the technology are particularly important when first encountering a technology, with system usefulness becoming more salient as users apply the technology in context.

The model shares concepts from the models and theories described earlier. The concept of 'spirit', also used by DeSanctis and Poole (AST), is used to help describe the 'technology as designed'. The MTA incorporates the concept of mutual adaptation, like Leonard-Barton, Tyre and Orlikowski, and Orlikowski (SMOT). The MTA includes the decision to adopt as an outcome of initial exposure, as does Rogers (1995). The model also has similarities with the one developed by Tyre and Orlikowski in being inductively generated and highlighting the temporary nature of stabilisation. The MTA therefore provides a means of describing use of technology over time in a way that is quite nuanced, as well as being consistent with prior research. However, the model emphasises description over explanation and prediction, which is not unexpected given that the model emerged from empirical research. It therefore does not provide many insights into the underpinning or generative mechanisms that shape users evaluations and patterns of appropriation, other than to flag the need to identify the particular influences operating on users' evaluations of a particular technology.

2.4 Identification of a theory for understanding the use lifecycle

Each of the theories or models considered above have a variety of strengths and weaknesses that can assist in understanding one or more aspects of the use lifecycle, which are summarised in Table 2.2.

Relative strength	**Technology acceptance**	**Innovation Diffusion**	**Structuration**	**Adaptation**	**MTA**
Coverage of whole use lifecycle	Low	Medium	Low	Medium	High
Accessibility/parsimony	High	High	Low	Med-High	High
Understanding of dynamics of influences on and patterns of use	Low-Med	Low-Medium	Medium	High	High
IT artefacts considered at micro-level	Low	Low	High (AST) Low (SMOT)	Medium	High
Ability to explain process of change (explanatory power)	Low-Medium	Low-Medium	Medium-High	Low-Medium	Low-Medium
Inductive/empirical basis for model	Low	Medium	Low	Med (L-B) High (T&O)	High
Applied to range of user cohorts and use contexts	High	High	High	Medium	Medium
Includes mutual adaptation/bi-directional causality	Low	Medium	High	High	High
Focus on adaptation and stabilisation	Low	Medium	High	High	High
Stabilisation not privileged over adaptation	Low	Low	Medium	Low (L-B) High (T&O)	Medium
Incorporates context	Low	Low	High	High	High
Includes minimal use and rejection behaviour	Low	Medium	Medium	Low	High
Cumulative tradition	High	High	Medium	Low-Medium	Low
Heterogeneity of use across individuals	Low	Low-Medium	Medium	Medium	High

Table 2.2 Relative strengths of theories for understanding the use lifecycle

Understanding the whole lifecycle of IT use is of central concern in this research. Only the MTA provides coverage across the entire lifecycle from pre-use through to stabilised use. The model also facilitates understanding of the dynamics of influences on and patterns of use, and does so in a way that is readily accessible and quite parsimonious. Furthermore, it considers technology and relationships with users at the micro-level of analysis. It is for these reasons, as well as the additional strengths listed in Table 2.2, that the MTA is the most promising candidate theory for understanding the whole lifecycle of IT use. However, there are two areas where the MTA is less strong: its ability to explain the how and why of the

appropriation process; and the limited cumulative tradition. The later issue is addressed through drawing on this model in this thesis, thereby contributing to the ongoing establishment of a cumulative tradition. The former concern about explanatory power is addressed quite well in structurational models, but such power is diminished by their low accessibility and parsimony. What are required are theories of change that complement the MTA by enhancing its capacity to explain the appropriation process in a way that is readily accessible.

2.5 Theories of change

Van de Ven and Poole (1995) identified four 'ideal type' theories of change: lifecycle, teleology, dialectic and evolution. A lifecycle perspective explains change in terms of a sequence of phases through which the system of interest passes. The progression through the phases is presumed to follow a certain imminent logic or sequence that is pre-programmed. Whilst the environment influences how the entity expresses itself, such as the particular patterns of adaptation and stabilisation, as well as their timing, these types of change events are nevertheless mediated by the imminent logic, or what Van de Ven and Poole referred to more broadly as the generative mechanism (Van de Ven & Poole 1995). The use of a lifecycle perspective provides a way of generating rich descriptions of the entity of interest, as is the case with the MTA, as well as the two adaptation models (Leonard-Barton 1988; Tyre & Orlikowski 1994). However, such a perspective is somewhat limited with respect to explaining how and why the entity of interest changes or remains stable over time. This constraint can be overcome by juxtaposing additional theories of change and their associated generative mechanisms.

A teleological perspective frames change as being driven by the purposeful pursuit of goals (Van de Ven & Poole 1995). The generative mechanism is the enactment of goals, which in the IT domain would be undertaken by users or organisations. Users or organisations are seen to act as intentional agents working to achieve the fulfilment of their goals. Furthermore, these agents are presumed to be adaptive and creative in formulating and enacting their goals. Unlike lifecycle theories there is no prescribed sequence. Instead, there is "a repetitive sequence of goal formulation, implementation, evaluation, and modification of goals based on what was learned or intended by the entity" (p. 516). Cognitive rational theories in IS, such as many theories of acceptance and innovation diffusion, similarly assume that change is driven

by the intentionality of users, with users' intentions being informed by their beliefs and attitudes toward the technology of interest (Davis 1989; Pfeffer 1982; Venkatesh et al. 2003).

Dialectic theories explain stability and change by reference to the tension that exists between opposing or contradictory forces, such as that between advocates of the status quo, the thesis, and those promoting change, the antithesis (Van de Ven & Poole 1995). The types of outcomes resulting from tensions can be understood in terms of maintenance, substitution or synthesis. Maintenance describes the continuance of the status quo, with the thesis dominating the antithesis. Substitution occurs when the thesis is replaced by the antithesis. The third possible outcome is a synthesis between the thesis and antithesis, an outcome that is distinctive from its constituent elements. The generative mechanism or motor of change in dialectic theories is the tension or conflict that exists between opposing forces. None of the theories considered here clearly represents or draws on a dialectic perspective, although there are examples of such theories being employed in IS (Cho et al. 2007; Myers 1994; Robey & Boudreau 1999; Robey et al. 2002; Wilson & Howcroft 2005). Giddens' structuration theory incorporates dialectic elements by identifying the possible tensions that exist between human agency and the structural properties of the contexts within which humans are embedded. The synthesis from this tension is the process of mutual constitution of agency and structural properties. However, it is not clear how agency or structure could exist independent of the other, as is the case in the dialectic theories described by Van de Ven and Poole (1995).

Evolutionary theory views and explains change as occurring through a continuous generative process of variation, selection and retention (Van de Ven & Poole 1995). Variation comes about due to random or unpredictable changes or events. Selection occurs through competition for scarce resources in the environment. Retention refers to maintenance of an entity's form; it serves to counteract the "self-reinforcing loop between variations and selection" (p. 518). An evolutionary perspective therefore captures the tension between change and inertia associated with the status quo or temporary stabilisations. The role of unpredictable discrepant events in explaining additional adaptations in the research by Tyre and Orlikowski is an example of research that is consistent with an evolutionary perspective. There are studies that have also more explicitly drawn on one or more aspects of evolutionary theory in the IS domain such as co-evolution (Fidock 2002; Kim & Kaplan 2006), and punctuated equilibrium (Lyytinen & Newman 2008; Mendoza et al. 2007; Sabherwal et al. 2001).

The teleological, dialectic and evolutionary lenses, together with the lifecycle perspective offered by the MTA, offer the potential of providing greater understanding of the lifecycle of IT use than would be provided by drawing on only one theoretical perspective. This is because particular theoretical perspectives, as metaphorical devices or lenses, draw attention to particular features or qualities whilst also leaving out others. It is the integration and juxtaposition of these theories to develop new theory that has stronger and broader explanatory power than the initial perspectives" (Van de Ven & Poole 1995, p. 511).

2.6 Summary

This chapter outlined the lifecycle of IT use and analysed the variety of concepts employed to describe system use. Very few researchers have considered use over the whole lifecycle or even over three phases. Instead, the majority of research only provides a partial view of use across the lifecycle. Analysis of influences on use and patterns of use at different phases of the lifecycle found that influences and patterns both change over time. A range of theories used to explain use was evaluated and a candidate theory well suited to explaining the lifecycle of use was selected, the MTA. The MTA covers the entire lifecycle from pre-use through to stabilised use, as well as incorporating many of the strengths of the other theories and models. However, the MTA is somewhat weak with respect to explaining the how and why of changes in patterns of use over the lifecycle. To address this weakness, additional theories of change and their associated generative mechanisms could be incorporated with the MTA.

Chapter 3: Research design

3.1 Introduction

The design of this research was shaped by the intent to examine the lifecycle of IT use, and in particular, to answer the question: why do users' appropriations of IT artefacts vary? A review of the literature found that few studies considered use over the whole lifecycle, or developed theories that describe and explain the whole lifecycle, except for the model of technology appropriation (MTA). The review also found that studies could be grouped based on their emphasis on understanding the extent of use or the nature of use. These studies also tend to adopt particular research approaches that can be classified as quantitative and qualitative respectively.

This chapter examines the role of research approaches in shaping the description and explanation of phenomena. For the phenomena of use and appropriation of technologies, a research approach combining qualitative and quantitative approaches is advocated, underpinned by a realist pragmatist philosophy. The research questions are outlined. The rationale behind adopting a multiple case study design with cases drawn from Defence is explained, as is the selection of participants. Five broad classes of methods are then described including the types of data provided and their application in this research. The measures and questions selected to investigate influences on and patterns of appropriation are summarised, as is the data analysis and theory building approach.

3.2 Researching use and appropriation

A variety of research approaches are used by IS researchers to examine use and appropriation. These approaches fall broadly into two categories, quantitative research and qualitative research. These two research approaches offer alternative and partial understanding of use and appropriation. They also provide different conceptualisations of these constructs, and influence the types of theories that are developed.

3.2.1 Research approaches

Quantitative research approaches involve numeric data, analysed using statistical methods (Dey 1993). They draw largely on survey-based methods (Burton-Jones & Straub 2006; Orlikowski & Baroudi 1991). Measures are carefully developed to ensure their validity and reliability, thereby providing an objective foundation upon which to make inferences about the extent to which associated variables are manifested (Hovorka et al. 2008; Lee 1999; Morgan & Smircich 1980). A number of measures are usually assessed in order to test hypothesised relationships between independent and dependent variables. In the case of system use it is commonly construed as the dependent variable, with researchers seeking to identify which particular independent variables best predict the variation in occurrence or magnitude of use. Quantitative research therefore adopts a perspective whereby use tends to be framed as a thing that changes in value but not in identity or character. Use is largely conceptualised as the extent of use with little attention given to exploring or defining the use concept (Burton-Jones & Straub 2006). Furthermore, use is theorised to be driven by intentions, which in turn are shaped by beliefs and attitudes toward the system of interest (Davis 1989; Rogers 1995). Such research is well suited to answering questions such as, what are the variables that best predict the extent of use of e-mail?

Qualitative research approaches draw on linguistic data, often transcribed or captured as text, which is analysed using methods concerned with classifying and describing phenomena, as well as seeing how concepts and themes interconnect (Dey 1993). Such approaches typically provide richer descriptions of the nature of use. These descriptions often entail a processual or longitudinal aspect, where change in the phenomena of interest unfolds over time (Dey 1993). Unlike system use investigated from a quantitative perspective, the concepts used to describe use are often defined in qualitative approaches. For example, technology appropriation is defined as the process through which users adopt, adapt and integrate a technology with their personal, social and work practices (Carroll 2004). Theorising from a qualitative process research perspective draws on diverse referent theories. But as was seen in Chapter 2, the theories adapted or developed have in common a concern with adaptation, context, and describing or explaining the dynamics of influences on and patterns of use. Qualitative research is suited to answering questions such as, how do users make use of e-mail in a particular context and what are the particular influences on changes in their use patterns over time? Answering this question may draw on interviews, focus groups, observations, notes

from meetings and conversations, historical recollections, data collected over time, as well as users' descriptions and demonstrations in context (Carroll et al. 2003a; Holtzblatt & Beyer 1993; Leonard-Barton 1988; Mendoza et al. 2008; Tyre & Orlikowski 1994; Wixon et al. 1990; Wolfe 1994).

3.2.2 Combining research approaches

Combining quantitative and qualitative research approaches has the potential to provide richer and more complete concepts and theories for explaining use and appropriation. Quantitative research can assist in answering "what" questions, and qualitative research can answer "how" questions (Van de Ven & Poole 2002). Qualitative research also can assist in answering "what" questions, particularly those related to emergent influences on users' patterns of use. When coupled with relevant theories of IT change, each approach also can assist in answering "why" questions by identifying significant influences on users' choices and behaviours around use of IT, as well as the generative mechanisms that underpin processes of change in socio-technical systems. Quantitative research supports statistical control that serves as a form of statistical experimentation (Lee 1999). This control reduces some of the complexity of the phenomena of interest and can provide a way of examining the strength of relationships between influences on use and the extent of use. However, the nature of quantitative research is such that the range of behaviours explored is limited to those identified a priori and individual differences are reduced to means, standard deviations, and path coefficients. Constraining avenues of inquiry prior to data collection combined with frequent use of cross-sectional research designs means that quantitative research largely provides aprocessual, acontextual, and ahistorical accounts of system use and its antecedents (Pettigrew 1990; Ramiller & Pentland 2009). Qualitative research addresses these weaknesses, by enabling the development of rich accounts of the unfolding nature of use that is situated in context.

The practice of mixing methods is widespread in IS research and other social and behavioural sciences (Bryman 2006a; Gable 1994; Lee 1989; Lee 1991; Sabherwal & Robey 1995; Tashakkori & Teddlie 2003). For example, quantitative survey-based researchers have employed interviews in the exploratory phase of research to inform the development of scales (Davis 1989). Similarly, qualitative process-orientated researchers have used quantitative data to represent the dynamics of use, through representing fluctuations in the frequency of adaptations over time (Tyre & Orlikowski 1994). However, whilst there are many examples

of mixing methods, the prevalence rates compared with pure quantitative or qualitative research are still quite small: 6% in pure social and behavioural science journals and 16% in more applied journals (Alise & Teddlie 2010). Furthermore, it is difficult to find examples of research combining quantitative and qualitative research approaches; research which combines the statistical inference making associated with much quantitative research, with the rich and context laden descriptions and explanations provided by qualitative research. Why is more research not undertaken or reported that draws on both of these approaches? The separation of approaches may be a function of the time it takes to become competent in the application of particular methods, the tribal nature of the research communities associated with each approach, or represent a manifestation of concerns about the capacity to effectively reconcile competing paradigms that are argued to be incommensurable (Mingers 2004; Truex et al. 2006).

3.2.3 Philosophical assumptions

Research approaches are underpinned by epistemological and ontological assumptions. Quantitative survey-based researchers see knowledge as generated through application of the scientific method and adopt an objectivist ontology such that IT artefacts are viewed as objective artefacts (Lee 1999). Alternatively, many qualitative researchers see knowledge generation as social practice and adopt somewhat of an anti-realist ontology that views IT artefacts as subjectively constructed, representing the expression of human agency (e.g. Kling & Iacono 1989). These research approaches are commonly associated with particular paradigms, positivism and interpretivism respectively, but such associations do not preclude their use by researchers who subscribe to alternative paradigms (Carlsson 2004; de Vaujany 2007; Mingers 2001). This is because in practice many IS researchers are directed toward one or other of these paradigms but do not strongly adhere to all of the tenets. For example, few interpretivists would adopt an extreme anti-realist position such that if I forget that the tree outside my window exists it therefore ceases to exist. If one assumes that two paradigms are not binary positions, but are instead directions, then it follows that the association of a research approach with a particular paradigm does not equate to a necessity to wholly adopt the same paradigm.

This thesis adopts a realist pragmatist philosophy that judges the value of research approaches, and the propositions and theories they help to test and build, based on their

capacity to be of practical usefulness, and relevance, rather than their mostly commonly associated paradigms (Bryman 2006b; Marshall et al. 2005; Wicks & Freeman 1998). Usefulness and relevance are determined through dialogue with stakeholders: other IS researchers, practitioners and research participants (Marshall et al. 2005). It might be argued that this is a form of research by consensus that borders on relativism (Klein et al. 1990). However, with pragmatism there is a requirement to test theoretical propositions for coherence with other theories and associated beliefs, and for these propositions to be generated through and supported by argument (Marshall et al. 2005). The addition of realism to pragmatism further adds a belief in a world that exists independent of human thought, a world that can be empirically observed, although such observation is necessarily mediated through the senses, beliefs, social context and so on (Mingers 2004). IT artefacts are physically embodied as well as being social situated (Mingers 2004). A realist pragmatist position should not be mistaken for an 'anything goes' attitude since this could lead to a failure to attend to the challenges and problems specific to quantitative or qualitative research approaches, due to having only a surface level appreciation (Truex et al. 2006). Drawing on these two research approaches therefore requires sufficient inculcation in the methods and theories associated with each approach (Truex et al. 2006).

Realist pragmatism is but one possible philosophical context within which a combination of qualitative and quantitative research could be employed. Isolationists accept the argument for paradigm incommensurability such that "research should develop separately within each paradigm" (Mingers 2004, p.88). By contrast there are a variety of non-isolationist[2] positions that have been identified, which advocate drawing upon a diversity of research methods and paradigms (Klein et al. 1990; Mingers 2004). These approaches range from those that are method centred and agnostic with respect to paradigms, such as pragmatists, through to those that put forward a revised ontology and epistemology suited to information systems, such as critical realists (Mingers 2004).

[2] The term pluralist was not used as it is has at least two meanings that are at odds. It is sometimes used to describe those who argue for a contingent view of choosing research approaches, such that the choice of approach and associated methods should be driven by the nature of the phenomena of interest and the strengths and weaknesses of the particular approaches in surfacing insights about the phenomena (Klein et al. 1990, Mingers 2004). But it is also associated with a relativistic view of science such that there is no way of arbitrating between different ways of coming to understand the world (Klein et al. 1990). Pluralists, so defined, would be non-isolationist but would not see any possibility of contingently combining methods, as advocated in this thesis.

3.3 Research questions

Having examined research approaches and philosophical positions of IS, attention now turns to one of the main influences on the research design, the research questions. The overarching question addressed by this thesis is 'Why do users' appropriations of IT artefacts vary?' This question has been decomposed into four research questions:

a. What are the influences on appropriation in a particular organisational context?
b. What are the patterns of appropriation in a particular organisational context?
c. How effective is the MTA in building understanding of variations in users' appropriations in organisations?
d. In what ways can the explanatory power of the MTA be improved?

The discussion in chapter 2 highlighted the potential of the MTA as a theoretical model suited to understanding the use lifecycle. The model represents variations in users' appropriations over time, through describing the process through which they first adopt, then adapt and incorporate the artefact with their practices. The MTA also explicitly conveys the heterogeneous patterns of use across individuals. However, the model is somewhat limited with respect to its explanatory power, that is, its ability to explain the appropriation process. The model does not adequately address the reasons why users' appropriations vary. The central question of this thesis is therefore directed toward understanding the reasons why users' appropriations of IT artefacts vary, where variation is manifested by the same user over time or between different users.

The first two research questions ('a' and 'b'), aim to build empirical understanding of the phenomena of interest: users' appropriations of IT artefacts in organisations. In the MTA, cohort and technology-specific influences are presumed to shape users' evaluations, decisions and behaviours. The MTA is intended to be contextualised for particular cohorts and technologies which are situated together within particular contexts. Therefore the identification of influences needs to be similarly situated, which in this thesis entailed a number of particular organisational contexts within the larger Defence organisation. The MTA also draws attention to adaptations in the IT artefact and associated practices, and the consequent heterogeneity in patterns of appropriation across individuals, as well as changes in patterns over time. The identification of patterns therefore is an important aspect of examining variations in users' appropriations over time or across users.

Refining and extending theory is an important goal of this research, in particular, revising and augmenting the MTA so that it can more accurately account for the process of appropriation. To do this effectively requires a critical examination of the effectiveness of the MTA in explaining the process of appropriation (question 'c'). This critical examination may also suggest the need to modify how the MTA describes the process of appropriation, if required.

The MTA is well suited to understanding the lifecycle of IT use, but its explanatory power is somewhat limited. Augmenting the MTA with the three additional theories of change (teleology, dialectic, evolution) and their associated generative mechanisms, is proposed as a way of improving the explanatory power of the MTA (question 'd').

3.4 Design of research

The research design was shaped by the research questions and the realist pragmatist frame adopted by the researcher that led to a combined quantitative-qualitative research approach. This combination provided the statistical rigor, control, efficiency of data collection and analysis of a quantitative survey-based approach. It also provided the richness of data and sensitivity to context, both current and historical, afforded by a qualitative process orientated approach. Addressing the research questions was undertaken by adopting a multiple case longitudinal design, where each case was located in Defence. These choices are justified in the following sub-sections.

3.4.1 Participant and site selection

This research used both quantitative and qualitative research approaches. The use of inferential statistics is a common feature of quantitative survey-based research. Therefore the goal in each case was to select survey respondents that would provide a cross section of people that was representative of the wider population from which they were drawn (Ezzy 2002; Kemper et al. 2003; Punch 2005). Qualitative data were obtained from participants primarily via interviews. Whilst efforts were made to achieve representativeness, participant selection was partially driven by the accessibility of potential participants, referred to as a convenience sample (Ezzy 2002; Punch 2005). The participants in each case were therefore

only partially representative (further details about participants in each case can be found in Chapters 4, 5 and 6).

This study was undertaken within an organisational context, Defence. Defence provides an extreme organisational context which manifests strong structural and cultural imperatives to control use and thereby limit adaptations and variability in patterns of appropriation across individuals and over time. However, the generic MTA broadly predicts that adaptations to technology and associated practices will occur over time and that patterns of appropriation across individuals are likely to be heterogeneous. Defence therefore is well suited to examining the effectiveness of the MTA in explaining the process of technology appropriation in organisations. If evidence of heterogeneous and dynamic appropriations is found in such a constrained context then this would suggest that the MTA has utility in less constrained organisational contexts.

3.4.2 Multiple case longitudinal design

A multiple case study research design was selected (Benbasat et al. 1987; Leonard-Barton 1990; Tyre & Orlikowski 1994; Yin 2003). Three case studies were identified to provide overlapping coverage across all of the phases of the appropriation process as represented by the MTA[3] (see Figure 3.1).

[3] Note that the word 'appropriation' has been replaced with 'stabilisation' in the interests of minimizing conceptual confusion between the process of appropriation, which covers the entire model, and appropriation, which just describing stabilization or incorporation.

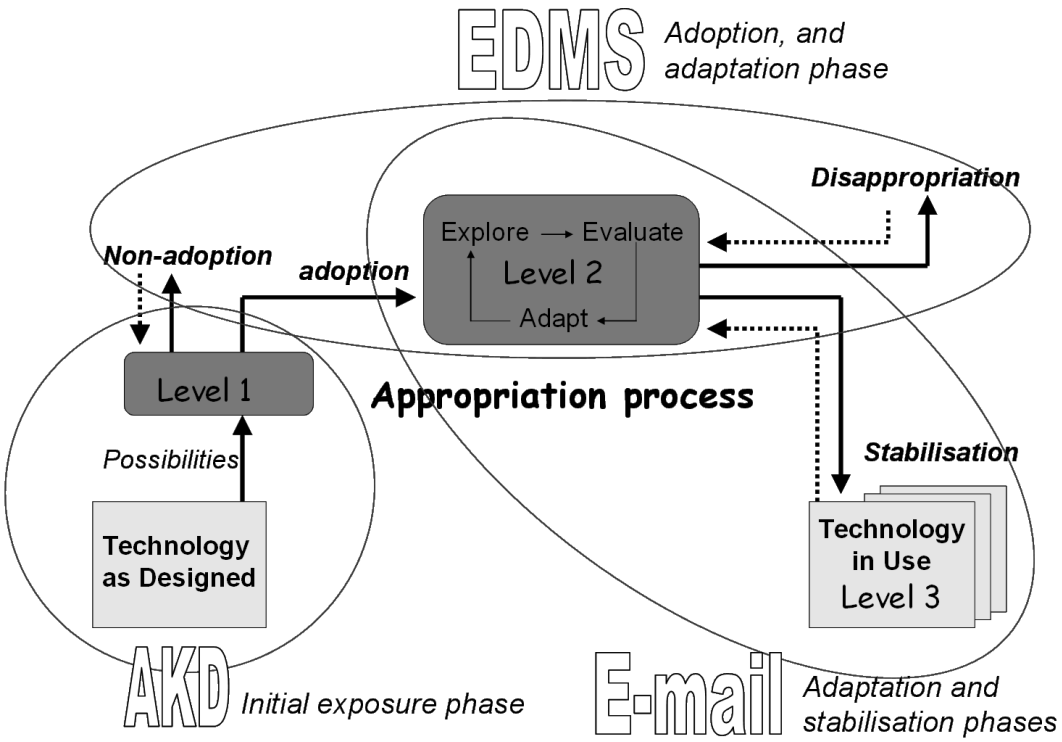


Figure 3.1 Mapping of IT artefacts onto the appropriation process

These cases involved different user cohorts and technologies, which provided a firmer basis upon which to generalise, as well as minimising research bias (Kaplan 1990).

- The Army Knowledge Domain (AKD) case: covered the initial exposure phase of the appropriation process for a prototype technology.
- The Electronic Document Management System (EDMS) case: examined the adoption decision and the adaptation phase for a recently implemented system.
- The e-mail case investigated a mature and widely used technology, which facilitated an assessment of stabilised patterns of use at the stabilisation phase. However, adaptations to these patterns can again occur if users' evaluations of the technology change. The data from this case therefore also assessed the adaptation phase.

A longitudinal design was used in all cases in order to examine the unfolding of the appropriation process over time (Neuman 2006). The three cases each covered two of the four phases of the lifecycle of IT use: pre and initial use for the AKD, pre-use and adaptive use for EDMS, and adaptive and stabilised use for e-mail. In combination, the cases provided coverage across the entire lifecycle of IT use, from pre-use through to stabilised use. The selection of cases each covering two phases, and embedded within the same organisational context, overcame some of the constraints associated with single phase studies with respect to

aggregation of findings. Nevertheless, inferences about the whole lifecycle of IT use in this study were somewhat constrained by not having a single case that covered all phases of the lifecycle.

Multiple methods, sources of data and analysis approaches were used so as to facilitate triangulation, which strengthened the knowledge claims made (Barley 1990; Carroll et al. 2002a; Trauth & O'Connor 1990). The methods and analysis approaches are described in sections 3.5 and 3.7 respectively.

3.4.3 Theory development approach

Recall from chapter 2 that the initial model selected to describe and explain the lifecycle of IT use was the MTA. It was chosen because it is a generic process model of the interactions between users and technology that can be contextualised for different technologies, and user cohorts (Carroll 2004). The model and underpinning theory was tested, adapted and extended through data collected from three case studies that span one or more phases of the appropriation process. In the first instance, this involved contextualising the MTA by drawing on the findings for a given case. This contextualisation involved the inclusion of the case specific influences and patterns of appropriation. Contextualisation was followed by a critical evaluation of the fit between the core elements of the model and case findings, where the core elements represent those features of the MTA that existed prior to contextualisation, that is, those elements described in chapter 2. In addition, the case findings were examined using the three additional generative mechanisms (teleology, dialectic, evolution), to determine what additional explanatory power was provided by their inclusion (Hovorka et al. 2008). A cross-case analysis was then undertaken to identify findings in common and those unique to particular cases. From this an MTA contextualised for all three cases was developed. An enhanced MTA for organisations was then derived by addressing the issues raised about the MTA in each case, and by drawing on the generative mechanisms. The approach taken to developing theory in this research is summarised in the figure below.

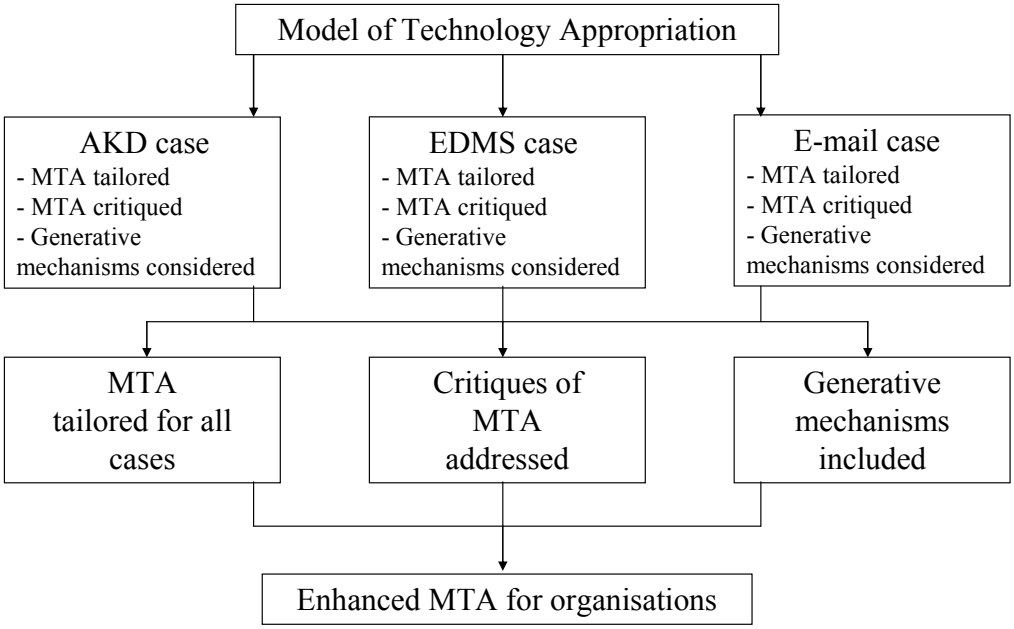


Figure 3.2 Theory development approach

3.5 Research methods

Consistent with Yin's (2003) definition of a case study, this research used multiple methods and sources of data. Interviews and questionnaires were the primary sources of data, however, observations, experimentation and documentary evidence were also used. The methods selected in each case are summarised in Table 3.1 below. Each of these methods and sources are explained in the following sub-sections.

	AKD	EDMS	E-mail
Interviews			
Repertory Grid	✓	✓	✓
Semi-structured interviews	✓	✓	✓
Contextual interview	✓		✓
Anecdote circle	✓		
Questionnaires			
Rating-scale + written comments	✓	✓	✓
Observations	✓	✓	✓
Experimentation	✓		
Documentary evidence	✓	✓	✓

Table 3.1 Methods used across cases

3.5.1 Interviews

Interviews can be categorised by how they are undertaken, the degree of structure, and number of interviewees. Interviews can be conducted over the phone and by use of surveys, but they are usually conducted face-to-face and involve verbal interchange with the interviewer directing or guiding the direction of the interchange (Fontana & Frey 2005). They can be structured, semi-structured or unstructured, and usually involve one interviewee but can also be undertaken with groups (Fontana & Frey 2005). Structured interviews follow a pre-defined list of closed questions that have prescribed response options such as questions requiring yes/no responses. Semi-structured interviews also draw on a pre-defined list of questions, but the questions are open-ended and represent themes and issues that the research would like to explore (Bryman 1989; Chae & Poole 2005). Furthermore, the researcher has the flexibility to introduce new questions to follow up on issues raised by interviewees. Unstructured interviews do not follow a list of questions; instead the interviewer may employ a simple schedule to guide the direction of discussions (Fontana & Frey 2005). The interviewee has considerable freedom to share their story or insights, which is diminished somewhat in a semi-structured interview and absent in a structured interview.

Interviews, particularly those used in qualitative research, are a powerful way of building understanding of people's beliefs, perceptions, and constructions of reality (Punch 2005). In this study the predominant approach to interviewing was with individuals face-to-face following a semi-structured questioning approach. A semi-structured approach was preferred in this research because adaptations to technology and associated practices, as well as changes over time in influences, are posited to be generic features of the technology appropriation process (Carroll 2004). The researcher therefore had particular aspects of the appropriation process requiring examination via a pre-defined set of questions. However, the phenomenon of appropriation has emergent features and therefore was best examined through not overly constraining the response options open to interviewees. The ability to surface adaptations and changes over time, particularly ones which are context specific, would not be possible using a structured approach.

Many of the semi-structured questions followed a traditional open-ended question style, such as "What do you like most about the prototype?" In addition, a particular form of semi-structured interviewing called the repertory grid was selected for use (Reger 1990). This

interviewing approach was developed by the clinical psychologist George Kelly in the 1950s to assist in eliciting clients personal constructs (Tan & Hunter 2002). Kelly argued that these constructs develop out of people's needs to cope with future events, and reflect their experiences of the world (Stewart 1997). From a research perspective, repertory grid facilitates the elicitation of people's beliefs about phenomena of interest in a way that minimises the influence of the researcher (Stewart 1997; Tan & Hunter 2002; Whyte & Bytheway 1996). Repertory grid is composed of three components: elements, constructs and links (Easterby-Smith 1981). Elements are the objects or phenomena of interest, such as different communications channels, or information systems (Reger 1990). These elements can either by provided by the researcher or elicited from the interviewee or a combination of the two. Constructs are interviewee's interpretations or beliefs about the elements. They are commonly elicited through presenting the elements in triads, either randomly or systematically (Reger 1990). For example, the researcher may select the elements 'car', 'train' and 'donkey'. The interviewee is then asked to consider how two of the elements are like each other but different from the third (Reger 1990). The interviewee produces bi-polar statements about the elements, such as, car and donkey are alike because they only can carry a few people, whereas a train is different because it can carry many people. The third component of repertory grid is links. Links show how interviewees relate the elements of the triad to the elicited constructs (Tan & Hunter 2002). For example, the element 'donkey' might be judged as closer to the 'carry few people' pole, with car a little further toward 'carry many people' and 'train' judged as close to the 'carry many people' pole. Due to time constraints often associated with conducting field research in organisational settings (Buchanan et al. 1988) the link component of repertory grid was excluded. However, interviewees were asked to talk through and provide additional explanations for their bi-polar statements.

Contextual interviewing was an additional form of semi-structured interviewing used in this research (Holtzblatt & Beyer 1993; Holtzblatt & Jones 1993). As the name suggests, this interview approach is concerned with eliciting data within the context where the phenomena of interest is manifested. It was an approach developed by Holtzblatt to facilitate richer understanding of work practices to inform the design of computer systems (Holtzblatt & Beyer 1993). A researcher or designer using contextual interviewing seeks to place the user at the centre of the design process through understanding the world within which they inhabit in doing work. However, unlike ethnography, from which it borrows, contextual interviewing is designed to surface information quite rapidly about how the person conducts their work and

reasons for the choices they make. For this research, the above approach was modified to allow a partial view of the use of IT and related artefacts to be elicited in about 30 minutes. This was achieved by being more directed and structured. For example, in the e-mail case participants were asked to describe and demonstrate what they do when checking emails.

Focus group interviews were undertaken, with the researcher cast more in the role of facilitator than interviewer (Punch 2005). A particular type of focus group method called anecdote circles, or storytelling circles as they were originally called, was selected (Callahan 2005b; O'Toole et al. 2008; Snowden 2000). The idea behind anecdote circles is that through sharing of anecdotes the values and beliefs of organisational members can be surfaced in a way that is situated in the context of a recounted experience. Anecdote circles are therefore designed and facilitated so as to elicit data about participants' experiences rather than their opinions or judgements (Callahan 2005b). Prior to conducting an anecdote circle, themes and issues that are to be explored are identified and questions developed. The questions should first provide a context or frame of reference, then employ an image-building phrase such as "think about a time when" to assist people in remembering events (Callahan 2005a). The question then concludes with an open question that contains a range of possible reactions. For example, the following question was used in the AKD case:

> *People draw on a variety of resources to support them when undertaking learning activities such as other people, ADEL, hard-copy publications and so on. Can you think of a time when one or more resources was particularly helpful in supporting your learning. Conversely can you think of a time when one or more resources was unhelpful or hindered your learning?*

The facilitator's role is to use open-ended probes to help draw out participants anecdotes, and to guide them toward providing concrete examples when opinions or judgements are offered (Callahan 2005b). Such probes are kept to a minimum so as to allow participants, who usually number between eight and twelve, the space to build on the anecdotes of others.

3.5.2 Questionnaires

Questionnaires are a means of collecting data usually independent of the researcher via a survey completed by a respondent (Babbie 1992). Questionnaires can be highly structured and focussed on codification and quantification, or they can be qualitative, providing a more participant-centred narrative account (Bryman 1989; Shanks et al. 1993). In IS research that

adopts a quantitative approach, such questionnaires tend to employ Likert-type rating scales that generate quantitative data (Orlikowski & Baroudi 1991). These are used to measure various constructs or variables. Qualitative researchers also employ questionnaires to capture respondents' narrative accounts of phenomena of interest. In this research all of the above forms of questionnaire were selected. In most cases questionnaires were designed to collect both quantitative and qualitative data through use of rating scales and open and closed questions (e.g. see Appendix B.4). Closed questions were chosen to collect demographic information and for forced choice responses, such as yes/no, while open-ended questions were included to collect a range of qualitative data or to elicit comments associated with particular rating scales.

3.5.3 Observations

Observation entails adopting a role that may range from the complete or detached observer who stands apart or is removed from the setting of interest, through to the researcher who gains membership of the group that has one or more people contributing to the research (Adler & Adler 1994). In the latter case, there are three different types of group membership. Least involved in the group is the *peripheral member-researcher*, someone who avoids participating in group activities but still endeavours to create an insider identity so as to provide a more accurate and meaningful perspective on core activities of interest (Adler & Adler 1994). Next is the *active member-researcher*, who becomes involved with the group, and even takes responsibility for pursing the groups interests, but who does not fully commit to their values and goals(Adler & Adler 1994). The final type is the *complete member-researcher*, someone who studies a group or setting of which they are already a member, or becomes a member, in the course of conducting the research (Adler & Adler 1994). In this research, the researcher at various times adopted each of these three member roles, as well as undertaking detached observations. Observations were often made in the context of interviews conducted at people's workstations. For example, in the e-mail case, the researcher was able to check the application to see how many e-mails were in the inbox, e-mails unopened, and the number of e-mail folders, as well as obtaining a screen shot of the interviewee's e-mail configuration (Cavanagh 2003; Whittaker & Sidner 1996).

3.5.4 Experimentation

Experimentation involves a controlled investigation designed to test established hypotheses or to discover an unknown effect in nature (Kirk 2003). It is usually conducted in a controlled environment, such as a laboratory, but may also occur in the field or even statistically through controlling for the effect of a particular variable (Lee 1999). A common distinction is drawn between true experiments and quasi-experiments (Campbell & Stanley 1969; Gribbons & Herman 1997). True experimental designs entail the random assignment of subjects to the experimental condition and to a control group, while quasi-experimental designs do not. By randomly assigning subjects, a true design hopes to control for the effect of differences in the characteristics of subjects thereby enhancing the strength of true claims. An experiment using a quasi-experimental design was conducted in the AKD case. A two-period two-treatment (2x2) cross-over design was chosen, with participants allocated to groups based on rank (Jones & Kenward 2003). The military has a strong rank structure which can inhibit information sharing by more junior ranks. To address this, officers were placed in one group and enlisted members in the other group, although some enlisted members joined the officers in order to have more even group sizes.

3.5.5 Documentary evidence

Documents are an important source of data in social and information systems research (Punch 2005). They provide a capacity to go beyond what is captured from participants, to situate the views of participants within a wider historical and organisational context. Documents also can provide an additional data source that can be triangulated with data collected via other methods. In understanding the appropriation of the various IT artefacts examined in this research it was important to position users' choices and actions in the context of the 'technology as designed'. Documentary evidence, such as the requirements documents for the EDMS and AKD, was important in establishing the intentions of customers and designers in relation to the requirements of a particular system and the associated system functionality designed to meet the requirements. Documents were also examined to identify historical circumstances leading to the acquisition or modification of a system, such as previous evaluations of e-mail use in the workplace, or evaluations of systems that pre-dated the current system of interest.

3.6 Questions and measures

3.6.1 Influences on appropriation

Both qualitative questions and quantitative measures were chosen to elicit influences on appropriation.

3.6.1.1 Qualitative

Qualitative data were collected by interviews and questionnaires. Qualitative questions designed to identify influences on appropriation were largely semi-structured. In the case of the questionnaires, comments fields were included beneath many of the scales, with comments elicited relating to one or more items in the particular scale (e.g. see Appendix B.4). This led to the identification of themes related to many of the quantitative measures described below. In addition, semi-structured questions were included in both questionnaires and interviews to elicit beliefs and attitudes toward the particular IT artefact, such as "what do you like best about e-mail?", "what do you like least about e-mail?" and "what could be done to improve the e-mail application?" (Cavanagh 2003) (see Appendix D.3). This general pattern of asking about positives, negatives and a way of addressing the negatives is derived from Cunningham (1993). This pattern is intended to overcome the potential problem of negative response bias. Semi-structured questions were also included in each case to situate the IT artefacts in context. In the EDMS and AKD cases these questions were focussed on design and development, as well as the roles and aspirations of key stakeholders (see Appendices C.4 and B.5) (Crowston & Malone 1988; Owen & Rogers 1999; Rubin 2003). With the EDMS, implementation and change management issues were also included. Given the established and mature nature of e-mail, these issues were not assessed. Instead, e-mail was contextualised by getting participants to identify the range of communications channels and associated technologies they employed alongside of e-mail. This served as the initial step in the repertory grid.

The repertory grid interview technique provided an additional way of drawing out positive and negative attitudes and beliefs. This technique involves comparing three elements by asking in what ways two of the three elements are like each other but different from the third (Reger 1990). The three elements were contextualised for each case but were of the same general form with the IT artefact of interest, such as e-mail, compared and contrasted with

two similar technologies or modes of communication, such as face-to-face and telephone (see Appendix D.4). An additional element introduced into the AKD and EDMS cases was the inclusion of an ideal system or practice (see Appendices B.5 and C.3). For example, AKD participants were asked to compare the AKD, a current knowledge management system (KMS), and the ideal KMS (see Appendix B.5). The inclusion of an ideal system or practice assisted in drawing out participants' attitudes and beliefs toward the AKD and the EDMS, both of which were quite immature and not well established in context. This was unnecessary in the e-mail case since it is an established technology that is used alongside a number of other communication channels and technologies.

3.6.1.2 Quantitative

Quantitative measures included contextual measures, as well as belief and attitudinal measures (see Table 3.2). Contextual measures were largely elicited via questionnaires and included:

- Demographics, such as age, gender, length of service and rank;
- Attitudes towards computers in general, that is user's self perceptions of computer literacy (Clegg et al. 1997); and
- Competence in using the IT artefact of interest, that is, the ability to use the system adequately (Clegg et al. 1997).

•	**AKD**	**EDMS**	**E-mail**
Demographics	✓	✓	✓
Attitude toward computers in general	✓	✓	✓
Competence	✓	✓	✓
Training/ system support		✓	
Procedures/ guidelines		✓	
Usability	✓	✓	✓
Ease of use	✓	✓	✓
Usefulness	✓	✓	✓
Demands on users	✓	✓	✓
System design	✓	✓	✓
Future expectations (organisational)	✓	✓	
Functionality	✓	✓	

Table 3.2 Influences on appropriation: quantitative measures

In addition, satisfaction with training and system support (Clegg et al. 1997), as well as the procedures and guidelines for using the system, were also assessed in the EDMS case (see Appendix C.1). These two measures were not employed in the AKD and e-mail cases because these issues were either not relevant (AKD), or of very low prominence (e-mail) (see Table 3.2).

Seven measures were selected to elicit users' beliefs and attitudes toward various aspects of the IT artefacts, five of which were used in all three cases (see Table 3.2, also see Appendix C.1 for the particular items associated with these measures for the EDMS case):

- Usability, adapted from a measure developed by Clegg et al. (1997), assessed user satisfaction with the graphical user interface (GUI), navigation, reliability, responsiveness and other related issues.
- Ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p.320). Two items were chosen to assess user satisfaction with ease of use and ease of learning. Clegg et al. had included these two items as part of their usability measure, and derived them from the work of Davis (1989). This is because ease of use is recognised as a component of usability (ISO 1998). However, to aid in analysis, and to be consistent with prior survey-based research these items were combined to make a separate measure of ease of use.
- Perceived usefulness was adapted from the measure developed by Davis (1989). Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p. 320). This measure has three main clusters of items relating to job effectiveness, productivity, and the importance of the system to one's job. Both the ease of use and usefulness measures were adapted by changing the tense of the questions so as to reflect current use of the system rather than the future focus associated with the original items.
- Demands on user, which is the amount of cognitive effort required to use the system (Clegg et al. 1997). This measure was adapted to reduce the number of items.
- System design, assessed user satisfaction with the design of the particular artefact, and how well it met user needs (Clegg et al. 1997). This measure was modified to reduce the number of items and to improve the conceptual clarity.

Additionally, there were two measures included in the AKD and EDMS cases only. Future expectations (organisational), was selected to assess user's expectations that the system would lead to improvements in organisational functioning, such as improved access to information

(Clegg et al. 1997). The number of items was reduced. The other was a measure developed by the researcher to assess user satisfaction with the specific functionality provided by the AKD and the EDMS. The purpose of this multi-item measure was to assess user satisfaction with core functionality specific to each of these particular systems. For example, one item for the AKD asked how satisfied respondents were with the ability to search for information using the AKD. The development of these measures is consistent with the call for IS researchers to focus on the feature level of systems, rather than to treat IT artefacts as black boxes (Jasperson et al. 2005).

Functionality is conceptually related to usefulness, since it is via one or more functions that a system delivers efficiency or effectiveness dividends for users. However, they are distinct in the sense that functionality is centred on what the technology can do, whereas usefulness is focussed on the job impacts associated with use of the technology. Furthermore, some functions will have no clear link to job impacts, such as the ability to change the colour scheme of the AKD interface.

The quantitative measures considered above were derived from the literature, as well as designed by the researcher (procedures/guidelines and functionality). Measures from the literature were selected based on their prominence, particularly ease of use and usefulness, as well as their utility in helping to explain use of systems in previous research in the Defence context (Fidock 2004). All of the measures were adapted either to reduce the number of items, or to assist in contextualising the measures, such as through naming the particular artefact of interest.

3.6.2 Patterns of appropriation

3.6.2.1 Qualitative

Qualitative data about patterns of appropriation were in part taken from written comments on questionnaires, as well as querying interviewees about their responses to particular questionnaire items (voluntariness and habitual use in the e-mail case). However, the primary sources of qualitative data were interviews and observations. Observations were focussed on users' patterns of appropriation, and were broadly concerned with patterns of feature use and associated work practices, as well as adaptations to technology and adaptations to practices,

described further in the data analysis section below. Observations were made directly, as well as via screen shots (e-mail) or video data of screens (AKD).

The repertory grid interview technique provided insights about users' technology appropriation choices with respect to: learning and knowledge work practices (AKD), information management practices (EDMS), and communications and information management practices (E-mail) (see Appendices B.5, C.3 and D.4).

Standard semi-structured questions were used. The AKD had yet to be deployed, so participants were asked if they would use this system in the future, providing an assessment of behavioural intention. They were also invited to provide general comments about the tasks completed and associated technologies (see Appendix B.9). The status of the EDMS implementation and the extent of use across the HQs was examined (Appendix C.4). A number of semi-structured questions were included in the e-mail case (Appendices D.4 and D.5). For example, e-mail similes were elicited by getting participants to complete the sentence "e-mail is like…". Similes were elicited because they provided a way of identifying how e-mail was framed by particular respondents, how they made sense of it both cognitively and emotionally (Black 1979; Polley 1997). During the follow-up interviews, participants were asked if they had made any modifications or changed any settings to improve the look, feel or performance of e-mail, so as to reveal any adaptations over time.

Contextual interviews were included in the AKD and e-mail cases (see Appendices B.5, D.4, and D.5). Prior to the AKD workshops, participants were queried about their use of extant technologies used to support learning activities. During the AKD workshops, participants were asked about their appropriation choices. E-mail users were queried about the reasons for their particular screen configurations, use of reminders, as well as e-mail checking and filing behaviours (Weber 2004; Whittaker & Sidner 1996).

Anecdote circles were included in the AKD case to investigate participants' experiences of extant learning technologies, as well as the AKD (see Appendix B.9). For example, participants were asked:

> *You have had an opportunity to explore and use the AKD…What positive impacts did the prototype have on how you went about the tasks? Conversely, what negative impacts did the prototype have?*

3.6.2.2 Quantitative

Quantitative data to examine appropriation patterns was taken from interviews, questionnaires, observations and experimentation. Length of use and the extent of use where assessed in all three cases (see Table 3.3). In the EDMS and e-mail cases, questionnaire respondents were asked when they first started using the system (e.g. see Appendix C.1). This enabled determination of how many years and/or months a particular individual had been using the system. The length of use measure was incorporated following Atkinson (1991). In the AKD case, there was no prior exposure to the system, so length of use was equal to the length of the workshops. Appropriation is a processual phenomenon, this measure therefore provided a means of determining whether or not respondents had moved beyond the initial exposure phase.

	AKD	**EDMS**	**E-mail**
Length of use	✓	✓	✓
Extent of use	✓	✓ (I=general) (FU=specific)	✓ (interview/ observation)
Nature of IS use	✓		✓
Information quality	✓		
Behavioural intention	✓		
Habitual Use			✓
Use voluntary			✓

N/A = not applicable; I = initial; FU = follow-up

Table 3.3 Patterns of appropriation: quantitative measures

Measurement of the extent of use followed a similar pattern as for length of use, with the extent of use of the AKD determined by the activities undertaken during the workshops. For example, the number of questions completed using the AKD (see section 4.3.2 and Appendix B.6 for further details). In the EDMS case, the extent of use was determined using a widely employed frequency of use measure (e.g. Adams et al. 1992; Compeau et al. 1999; Davis 1989; Kim et al. 2005). Rating descriptors ranged from 'less than once a month' to 'several times per day' (Igbaria et al. 1997). This measure was used to assess the overall use of the EDMS. In addition, it was used to investigate variations in the number and frequency of particular document storage and management behaviours, as well as specific activities supported by the EDMS (see Appendix C.2). This was done to provide a more system and context specific assessment of use (Igbaria et al. 1995; Igbaria et al. 1997; Jasperson et al.

2005), as well as surfacing heterogeneous appropriations across individuals (Carroll 2004). The extent of use of e-mail was determined from interviews and observations, including review of screen-shots provided by respondents. Measures selected to assess use of e-mail included the number of messages sent on average each day, messages received, messages in the inbox, number of folders, frequency of filing e-mails and frequency of checking e-mails (Cavanagh 2003; Whittaker & Sidner 1996) (Appendix D.4).

In the AKD and e-mail cases a measure developed by Jain and Kanungo (2005) to assess the nature of IS use was chosen. This concept "is defined to be the degree to which a person differs from others in the way he or she uses a particular information system" (p. 115) (see Appendices B.4, D.2 and D.3). It was included because it provided an additional way of assessing heterogeneous system use across users. However, this concept covers but one aspect of the broader nature of use concept introduced in Chapter 2. The broader concept is concerned with describing qualitatively different patterns of use, not just if people's use differs.

Additional measures specifically suited to each of these cases were also selected. The AKD was a system yet to be implemented. In such situations, researchers have attempted to predict future use by assessing users' intentions to employ a system, referred to as behavioural intention (Agarwal & Prasad 1998; Davis et al. 1989; Karahanna et al. 1999; Mathieson 1991; Taylor & Todd 1995b) (see Appendix B.4). A measure assessing behavioural intention was therefore chosen to determine the possible extent of use following implementation. Information quality, or information satisfaction, was also measured (Doll & Torkzadeh 1988). This provided an examination of "the extent to which users believe the information system available to them meets their information requirements" (Ives et al. 1983, p. 785).This measure was included as the AKD was designed to provide access to corporately endorsed information. The e-mail case mapped onto the incorporation phase of the MTA, which is associated with stabilisation or routinisation in patterns of appropriation. A measure assessing the extent of automatic or habitual use was therefore included (Limayem & Hirt 2003) (see Appendix D.2). Another feature of the e-mail case was the absence of a clear mandate to use to system. However, there are social and organisational pressures to use e-mail, referred to as captive use (Adams et al. 1992). To examine the extent to which individuals felt captive to e-mail, a measure assessing voluntariness was chosen (Moore & Benbasat 1991).

3.7 Data analysis approach

Qualitative and quantitative analyses relating to influences and appropriation patterns independent of time were considered first so as to surface general themes and issues. The data were analysed from a temporal perspective to identify how influences and appropriation patterns changed over time. The results from the qualitative and quantitative analyses were then combined as part of the contextualisation of the MTA for each case and for the three cases combined.

3.7.1 Qualitative data analysis

The qualitative data were analysed through use of coding (Miles & Huberman 1994). Descriptive codes were in the first instance selected through drawing on the pre-defined concepts and issues associated with the process of technology appropriation that were investigated in the questionnaires and interviews (Carroll & Swatman 2000). Descriptive codes were also inductively generated as the data were iteratively re-read. The outcome of this process was the identification of themes related to influences on appropriation, and patterns of appropriation. Changes in influences and patterns over time were also investigated through examining the presence or absence of particular influences and patterns over time, as well as the salience and valence of particular themes (AKD, EDMS). In the e-mail case, variations over time in appropriation patterns were examined and the reasons for variations elicited.

The core pre-defined concepts from the MTA are adoption, non-adoption, adaptation, disappropriation and stabilisation, collectively referred to as different patterns of appropriation.

- Adoption and non-adoption are clearly associated with the initial exposure phase of the MTA (Carroll 2004). Adoption was therefore coded when there was evidence of a decision to use the technology in the context of work, and non-adoption when a decision was made to not use the technology after initial exposure.
- Within the MTA, a distinction is drawn between adaptations to the technology and adaptations to activities or practices to accommodate the technology (Carroll et al. 2003a). In the case of technology adaptations, a distinction was drawn between personalisations, customisations and inventions (Carroll et al. 2003a; Desouza et al. 2007). Personalisation efforts were modifications to the technology to primarily meet a user's aesthetic

preferences, such as changing the colour scheme of a user interface. Customisations entail modifications to the technology to meet functional preferences or requirements, such as hiding or showing particular toolbars. Inventions entail changes to the artefact through the creation of add-ins or the application of functions in novel ways. All of these definitions were adapted from those developed by Desouza et al. (2007). The primary way of examining adaptations to practice was through investigating changes in patterns of feature use over time, or changes in pre-existing practices due to the introduction of a technology. For example, changes in the frequency of sending e-mail messages over time, or having to perform additional steps to create a new document in Microsoft (MS) Word as required by the EDMS. Patterns of feature use are the particular sub-set of features that a user draws on to meet their needs (Jasperson et al. 2005). Assessing patterns of feature use provided insights into how a technology was being called on to support peoples' practices.

- Disappropriations where judged to have occurred when there was rejection of the technology.
- Stabilisations were coded where there was evidence of routinisation or habituation in patterns of technology use or associated practices (Carroll 2004).

3.7.2 Quantitative data analysis

Quantitative data for each case were analysed using descriptive and inferential statistics. Descriptive analyses included minimum and maximum rating responses, means, and standard deviations. In addition, analyses were undertaken to identify particular questionnaire measures and items that the majority of respondents judged as either positive or negative, which assisted in identifying group level themes and issues, as well as the distribution of positive and negative views about a technology.

Prior to performing inferential tests, multi-item measures were assessed to determine if they were sufficiently reliable to justify consideration as a single variable. This was achieved through calculating internal consistency reliability coefficients (Cronbach's alpha).

Correlation analyses, using pair-wise deletion of missing data, were selected in each case to identify statistically significant relationships between influences and various measures of appropriation. In addition, examining correlations with the length of use measure provided a way of undertaking a cross-sectional analysis of changes in influences and patterns of

appropriation over time (EDMS and e-mail). Correlation analyses were also undertaken in the e-mail case to identify changes in patterns of appropriation between the initial and follow-up data collection periods. Other inferential statistics included t-tests (EDMS), analysis of variance (AKD) and multivariate analysis of variance (EDMS). These tests were used to identify changes in influences and patterns over time from more than one data point (EDMS), or differences in performance using alternative technologies (AKD).

The number of participant responses available to support descriptive and inferential analyses varied across cases: In the AKD case 15 of 73 participants provided such responses; 54 in the initial phase and 32 at follow-up out of a total of 134 participants for the EDMS case; and 16 of 42 participants for the e-mail case. Whilst such sample sizes are modest, they are sufficient as long as the effect sizes for the relationships of interest are not small.

3.7.3 Temporal and cross-case analysis

Examining the process of appropriation requires analysis of changes in influences and patterns of appropriation over time. This was achieved through undertaking a cross-case analysis, with each case providing coverage of different sections of the MTA. The process of appropriation was also examined via the length of use measure, and through examining changes in influences and patterns of appropriation between data collection points for a particular case. These approaches provided a way of undertaking cross-sectional and longitudinal analyses of changes in influences and patterns of appropriation over time.

In order to undertake a cross-case analysis, the qualitative and quantitative findings from each case were each mapped using a concept mapping tool (ConceptDraw), as well as being tabulated. All of the maps employed the following first order categories:

- influences on appropriation,
- patterns of appropriation,
- influences over time, and
- patterns over time.

These maps were then combined so as to identify influences and patterns in common across the three cases, as well as those unique to a particular case (see Appendix E).

The cross case analysis also examined similarities and differences in the IT artefacts, contexts, and practices across cases.

3.8 Summary

The central research question addressed by this thesis is: why do users' appropriations of IT artefacts vary? To address this question, a research approach combining qualitative and quantitative approaches was advocated, underpinned by a realist pragmatist philosophy. A multiple case study design was adopted to facilitate investigation of appropriation throughout the whole lifecycle of IT use. Qualitative and quantitative methods were selected, as were a range of measures and questions. Analyses of the data obtained facilitated investigation of why and how users' appropriations of IT artefacts vary, through identifying influences on appropriation in particular organisational contexts, patterns of appropriation manifested, as well as influences and patterns over time. In this way, the findings enabled contextualisation of the MTA. Theory building also involved modifications to core features of the MTA, as well as incorporation of additional generative mechanisms.

Chapter 4: The Army Knowledge Domain case

4.1 Introduction

The Army Knowledge Domain prototype (AKD) was designed to support learning and knowledge practices within the Australian Army. The AKD was assessed during workshops and had yet to be implemented. Findings from these workshops enabled examination of influences on and patterns of appropriation during the initial exposure phase of appropriation, which includes pre-use and initial use. So as to identify possible appropriation outcomes following implementation, the influences, patterns and context associated with existing systems used to access Army information were also investigated. The research questions addressed by this case are therefore:

- During initial exposure to the AKD, why did users' appropriations vary?
    - What are the influences on appropriation of the AKD in the context of learning and knowledge practices in Army?
    - What are the patterns of appropriation of the AKD in the context of learning and knowledge practices in Army?

These questions are contextualised variants of the research questions described in Chapter 3. They have been made specific to a particular phase of the appropriation process (initial exposure), a particular technology (AKD), particular practices (learning and knowledge), and a particular context (Army). Being specific in this way is consistent with the sensitivity to context associated with the MTA, which is intended to be contextualised for particular cohorts, technologies, and practices situated together within a particular temporal and organisational context.

In this chapter the AKD case is outlined by describing important features of the organisational context, as well as extant technologies and practices associated with learning and work in the Australian Army. The research methodology is explained. The qualitative and quantitative results are presented, which, together with the case description, are used to contextualise the MTA for the AKD case. The findings are then examined through each of the four generative mechanisms.

4.2 Case description

4.2.1 The organisational context

Since the end of the Cold War, many Armies around the world have been confronted with dramatically alterated strategic contexts and priorities. Up to this point, military forces were primarily structured for conventional state-on-state warfare in a relatively stable strategic context. However, with the end of the Cold War, the warfighting environment has increased in complexity and uncertainty, driven largely by an enemy, terrorists and militia, who are not readily identifiable and who do not employ conventional weapons and tactics. Just as in the commercial world, such a shift in the environment places pressure on organisations to reconfigure in order to respond to the new circumstances (Aylwin-Foster 2005). This is achieved through organisations investing in technology, in its people, and through structural and cultural reforms (Groth 1999; Nadler & Tushman 1997; Purvis et al. 2001). However, Armies are strongly hierarchical organisations, with cultures imbued with tradition, and as a consequence changes can be difficult to implement (Macredie & Sandom 1999). The Australian Army has embraced the need for such reforms by: investing in new technologies, introducing substantial structural reforms, endeavouring to change its culture and further developing its people (The Australian Army 2005). Army personnel need to have appropriate technical proficiency, understanding of context, as well as the moral, physical and intellectual capacities to operate in complex and uncertain environments. Collectively, these attributes are referred to as professional mastery (The Australian Army 2002). There is recognition that the development of such mastery is underpinned by Army's culture, knowledge, training and education. It is as part of efforts to enhance professional mastery that a trial to develop the AKD was established. The development of an AKD was seen as providing a means of improving access to and sharing of current and relevant information within Army (The Australian Army 2007). It was seen as providing the means for Army personnel to gain access to information via a single point of access rather than through use of disparate systems. Army's efforts in this regard parallel similar efforts within US Defence (Mains & Geller 2008; Tharpe et al. 1999), in other government departments (Butler et al. 2008), and in the business world (Al-Alawi et al. 2007).

The trial to develop the AKD was conducted over 17 months, starting in July 2006. The trial represented the first phase of the plan to create a mature AKD and reduce the risks of a full

scale implementation by refining requirements, systems and concepts, and by introducing a more gradual change process. It was decided that a user-centred prototype development approach would be employed, supported by an ongoing evaluation.

At the time of the trial, Army personnel drew on a variety of information sources. These sources included policies, training materials, concept documents and overseas information sources. They also included:

- doctrine, which is the embodiment of Army's explicit knowledge of how it conducts its business in general, and
- lessons, which are the building blocks of doctrine and are generated to provide much more specific guidance to personnel.

The complete AKD, planned for completion by 2012, was envisaged to bring together these disparate information sources into one linked domain. However, given the time constraints associated with the trial, the decision was made to focus on only a part of the AKD, namely doctrine and lessons.

4.2.2 Practices associated with learning and work

Army personnel use doctrine and lessons as part of their learning and work practices. Doctrine is used by:

- Trainees preparing for and completing training;
- Instructors preparing teaching materials;
- People in Army who require access to doctrinal information to support the conduct of their duties, for example, through helping to clarify legal issues, military customs, and regulations associated with delivery of training; and
- Personnel preparing for military operations.

Lessons support learning needs, for example, by providing operations specific information to develop awareness of a particular military operation prior to deployment.

4.2.3 Extant technologies to support learning and work

Doctrine was accessed primarily using the Army Doctrine Electronic Library (ADEL) located on the Defence intranet. However personnel also accessed hardcopy doctrine as well as

printouts from ADEL. ADEL was the definitive and corporately sanctioned source for Army doctrine, which had been in operation since 1996. It was in widespread use within Army. ADEL had been developed in house by personnel largely drawing on open source software. The system had evolved over time with knowledge of this evolution residing with key system development and support personnel. As a consequence, the availability and maintenance of the system was dependent on a few key individuals. At the time of the study, ADEL was a relatively old system, which was perceived to suffer from problems with responsiveness and the quality of its search functionality.

Lessons were disseminated by e-mail, as well as via a system called Army Knowledge Online (AKO). The system also supported collaboration and provided space for communities of like-minded personnel to share insights with each other. It was a pilot system that was built on commercially-available collaboration and document management technology. This system had moved Army toward having a single point of access to many relevant sources of information. However, due to a variety of technical, organisational and cultural issues this system had failed to effectively deliver a single point of access. The system was not widely used by Army personnel, in part due to not being formally sanctioned as an information source.

4.2.4 AKD development and evaluation

The AKD was developed using a combination of open source software (AJAX[4]) and commercial off-the-shelf (COTS) technology to provide access to doctrine and lessons. An in-house team used AJAX to develop a web portal that would accept feeds from various repositories. The interface they developed provided access to this information via a series of tabs along the top of the interface, as well as via a tree structure in the left frame (Figure 4.1). In addition, an XML viewer to support user access to selected content was included in the centre frame. The portal also allowed users to click on words highlighted in italics to see the definition, presented in the right frame. The bottom frame was reserved for listing the ten most related information sources as identified by a COTS search engine. This search engine could also be accessed via a dialogue box at the top of the page.

[4] Asynchronous JavaScript And XML.

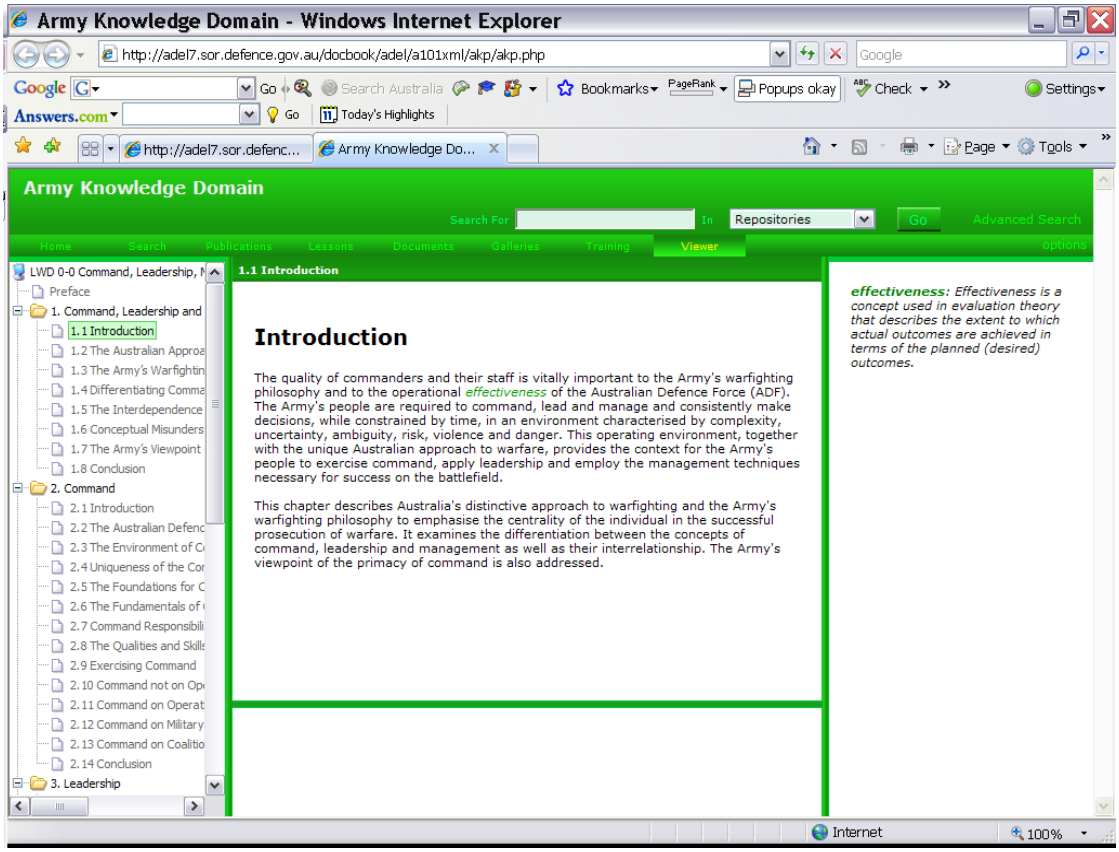


Figure 4.1 The portal

Due to problems integrating the search engine with the portal, access to the search technology was also provided via a COTS search interface called Retina (Figure 4.2), developed by Autonomy. The AKD was therefore composed of two distinct components accessed via a web browser: the portal and Retina. They both provided the capacity to access doctrine and lessons via a single point of entry.

Figure 4.2 The search interface: Retina

As part of the AKD trial, ongoing evaluation of the development process was undertaken. The researcher led this evaluation drawing on an appropriation perspective.

4.3 Research methodology

4.3.1 Participant characteristics

A total of 73 people provided data between May 2006 and November 2007. The composition was somewhat representative of the wider Army[5]:

- gender: 75% males (55/73) and 25% females (18/73);
- age: 21 to 57;
- rank: Lance Corporal (LCPL) to Colonel (COL)
- years of service: two to 33 years; and
- drawn from a variety of units and Corps[6]

[5] Army population characteristics:
Gender – 15% Female, 85% Male;
Rank – Private (PTE) to General (GEN), with 70% enlisted members (PTE to Warrant Officer (WO)) and 30% Officers (2nd Lieutenant (2LT) to GEN)

Twenty five of the participants assessed the AKD, with none of them having any prior exposure to the system. The remaining participants, together with the 25 users of the AKD, provided data used to build a description of the personal, technical and organisational context.

4.3.2 Research foci and methods employed

The AKD was a prototype system undergoing evaluation and so was well suited to examining the initial exposure phase of the appropriation process (see Figure 4.3).

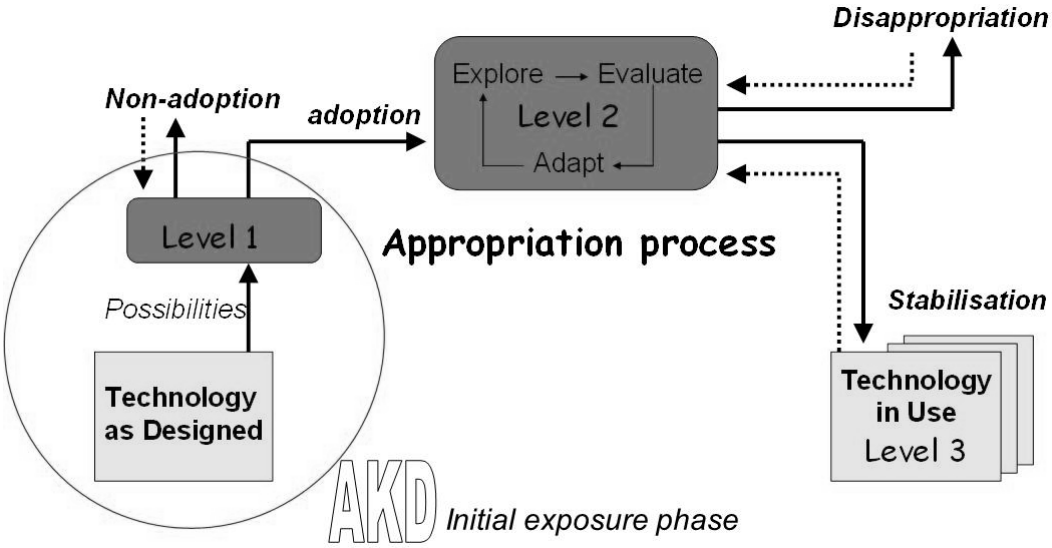


Figure 4.3 Mapping of AKD case to the MTA

The AKD was examined during workshops. The methods employed during the workshops are described below and summarised in Table 4.1.

[6] A subdivision or group of military personnel organised according to common activity or occupation. For example, Psychology Corps employs Army psychologist and test administrators.

Research foci	Method: - description	Issues assessed
Influences on appropriation	Feedback on interface designs questionnaire: semi-structured	Comments on colour, layout etc
	Initial impressions of AKD questionnaire: semi-structured	Likes, dislikes and areas for improvement
	AKD evaluation questionnaire: rating scales, semi-structured questions and space for comments	Satisfaction with AKD functionality; Usability (including ease of use) System design; Perceived usefulness; Competence; Future expectations (organisational)
	- Discussion on AKD: semi-structured questions and anecdote circle	Positives and negatives of AKD
	- Repertory grid	Resources used to support learning practices (inc. AKD) and needs that were or were not being met
	Journal: - ad hoc feedback sheets	Participants thoughts during tasks
Patterns of appropriation	Feedback on interface designs questionnaires	Rank ordering of interfaces
	AKD evaluation questionnaire	Information quality; Behavioural intentions; Nature of IS use
	Group interviews/discussions: - Feedback on task and technology	Comments on task and technologies used
	- Discussion on AKD: semi-structured questions and anecdote circle	Positives and negatives of AKD
	- Repertory grid	Technologies used to support learning practices (inc. AKD) and needs being met
	Lab experiment: - Completion of two sets of 22 questions using extant systems v AKD	Number of questions completed correctly
	Observation: - of system use during workshops	Nature of use
	Video capture: - of task completion	Nature of use and technology performance
	Journal: - Ad hoc feedback sheets	To capture participants thoughts during completion of tasks

Table 4.1 Research foci, methods and issues assessed: AKD evaluation workshops

Three workshops were held: two conducted over two days, and one taking 90 minutes. Fifteen people participated in the two-day workshops and 10 participated in the 90 minute workshop. Participants explored the usability and functionality offered by the AKD in comparison to existing systems, primarily ADEL and to a lesser extent the AKO, via completion of tasks analogous to what they might undertake as part of learning and work-related activities. During the two-day workshops four tasks were completed: answering 22 questions (analogous to pre-course preparation), preparing a PowerPoint briefing, preparing a handout on leadership and professional mastery, and preparing feedback for peers on the AKD (see Appendix B.6). The

handout on leadership was the only task completed during the 90 minute workshop. The workshops involved the use of multiple methods:

- Questionnaires (Appendices B.1 to B.4),
- group interviews (Appendix B.9),
- group administration of repertory grid technique (Two-day workshop only) (Appendix B.9),
- experimentation (Two-day workshop only),
- observations,
- video capture of system use, and
- journals (Appendix B.8).

The research methods are listed in Appendix B.7 and the schedule of activities in Appendix B.10.

Four questionnaires were completed during the workshops: a baseline questionnaire, an "initial impressions of the AKD" questionnaire, a "feedback on interface designs" questionnaire, and an AKD evaluation questionnaire. Only the initial impressions and baseline questionnaire were completed during the 90 minute workshop. Before putting the systems to use, participants in the two-day workshops were presented with an overview of the systems that would be employed to support the various tasks: primarily ADEL and the AKD (composed of the portal and Retina). Each system was presented for approximately 10 minutes.

a. The baseline questionnaire was completed prior to the overview of the AKD, so as to elicit evaluations of ADEL that were not influenced by seeing the AKD.
b. After familiarising participants with the two components of the AKD (Retina and the portal) and their core features, participants were asked to complete the initial impressions questionnaire (see Appendix B.3).
c. Next, participants were given an overview of six interface designs, including Retina, the portal, an alternative screen design for the portal, an American system, ADEL and the AKO. Each interface was presented for approximately one minute followed by 30 seconds during which participants were asked to write comments on the "feedback on interface designs" questionnaire related to use of colour, layout, use of space, and so on (see Appendix B.2). After all six interfaces were presented participants were asked to rank order them and comment on their rankings thereby providing a comparative assessment.

d. Toward the end of day two, following the completion of the four tasks, participants completed the AKD evaluation questionnaire (see Appendix B.4).

Comparison of the baseline and AKD questionnaires showed changes in users' attitudes following exposure to the AKD.

During the two-day workshops a quasi-experiment employing a two-period two-treatment (2x2) cross-over design was performed (Jones & Kenward 2003).The experiment involved the completion of two sets of 22 questions. The purpose of these questions was to actively engage participants with the technology through a task that was analogous to typical pre-course preparation. The participants were divided into two subgroups. One subgroup used extant technologies, ADEL and the AKO, to answer the first question set, then used the AKD (Retina and/or the portal) to answer the second question set. The second subgroup used the AKD on question set one, and extant systems on question set two. This comparative experimental activity was undertaken to identify any differences in system performance.

Two methods were used to collect data on how participants were using the systems: observations and use of video capture software (CAMSTUDIO).

The organisational context was investigated through semi-structured interviews with twenty people associated with the project, as well relevant documentation (see Appendix B.5). The focus was on understanding the development of the AKD, and the process within Army that develops lessons and doctrine. The personal and technical context was examined through data from workshop participants and from an additional 28 people. In particular, information about user attributes, extant technologies and associated practices was elicited through interviews and questionnaires (see Appendices B.1 and B.5). The interviews drew on three methods: a contextual interview, repertory grid and a semi-structured interview (as detailed in Chapter 3, section 3.5.1).

4.4 Results

The data were analysed to identify influences on participants' evaluations of the AKD including context, their appropriations of the system and how the influences and appropriation choices varied over time. General themes and issues were identified first. The data were then

examined from a temporal perspective. Analyses based on the qualitative data are presented first.

4.4.1 Qualitative data analysis

Qualitative data were derived from written comments on questionnaires and from journals, field notes taken during workshops, interviews and discussions, and from a range of different documentation. Interviews and discussions were audio recorded. The audio recordings augmented the field notes, rather than being transcribed in full. Influences on appropriation are presented first, followed by patterns of appropriation. Influences and patterns over time are then considered.

4.4.1.1 Influences on appropriation

In the initial impressions questionnaire, participants were first asked "what do you like most about the [AKD] prototype?" The majority of comments related to system functionality (13 of 15 participants) and ease of use/user friendliness (8). In particular, 10 participants liked the search functionality: *"Retina seems to be a good search engine"*; two people appreciated the cut and paste function of the portal due to its simplicity and there being *"no change to format"*. Four people also liked other functions provided via the portal such as the ability to *"save things to your individual profile"*. The ease of use and user friendliness of the portal or Retina were raised by eight participants and again related to search, cut and paste and the other system features: *"assuming the search engine works, the process should be much more user friendly"*.

Participants were also asked "what do you like least about the prototype?" Six participants had nil dislikes. The remaining nine people expressed concerns about a range of issues such as: the *"search for doc" + "search w/i[within] doc" options may be easily confused"*, *"the headings 'home, search etc' are in too small font"*, system responsiveness, and a query about the necessity of two systems (Retina and the portal). Six people provided suggestions for improving the portal, with improving the colour scheme of the portal an issue for a couple of people. The last question asked for any other comments. Four people were very positive, for example, *"initial impression is very positive"*. Another two people raised concerns, one related to systems performance once it was transitioned to the wider defence network due to

bandwidth contraints, and the other expressed a desire for the Retina search to be integrated with the portal.

Following the completion of the initial impressions questionnaire, participants were briefly exposed to six different interfaces: Retina, the AKD portal, and a variety of other interfaces. A selection of comments provided by the 15 workshop participants are summarised in Table 4.2 below.

Interface		**Overall rank order**
Retina	Search capability; Simple interface; Good design and colour; Like the folder hierarchy; Nice layout; Front page boring	1
Army Knowledge Online (US system)	*Access to email and other info sources; One central portal; Cluttered; Nice, crisp; Good colour*	*2*
AKD portal	Simple layout; Easy to use; More cluttered; Text too small; Colour poor; Different colour options; No borders on buttons	3
Mock-up for AKD portal	*Looks professional; Uncluttered; Better colours; Good layout; Don't like colour scheme, font [too] small*	*4*
Army Knowledge Online (AUS system)	*Too busy, Info hard to read; Cluttered; Logical grouping; Hard to search; Good colour*	*5*
ADEL	*Very busy; Cluttered, slow; Simple layout, easy to use; Good use of tabs at top; No abstracts with search results*	*6*

Table 4.2 Rank ordering of interfaces and associated comments

Most participants commented favourably on Retina's search capability. They liked the way the search results were presented and grouped into thematic folders (see left frame of Figure 4.2, below the search query box). For the portal, there were minimal concerns raised, other than a couple of comments about the colour scheme, and difficulties in differentiating tab buttons (refer Figure 4.1).

The repertory grid technique and group discussion provided a comparative assessment of the AKD, ADEL, an ideal KMS and a variety of other resources used to support learning and work practices. Fourteen participants contributed written comments, as well as discussing a selection of their element pairings with the group. Findings related to the 13 participants who compared the AKD and an ideal KMS versus ADEL are presented first. This is followed by the 10 people who compared the AKD and ADEL versus an ideal KMS. Finally, comments from the three people who paired ADEL and the ideal versus the AKD are considered.

- AKD and an ideal KMS versus ADEL: provided insights into users' needs that were already being met when compared to ADEL. All 13 participants saw the AKD as providing performance benefits over ADEL through being *"quicker"*, *"fast"*, opening *"documents quickly"* and having a *"faster search function"*. The ease of use and interface of the AKD was a feature for six people who saw it as *"user friendly"*, *"simple to use"* and *"uncluttered"*. Three people appreciated the functionality of being able to easily transfer information via cut and paste.
- AKD and ADEL versus an ideal KMS: highlighted requirements that were not being met when compared to an ideal KMS. Six people offered suggestions with respect to enhancement functionality. In particular, three people expressed a desire for a more integrated portal that would include e-mail, as well as other information such as weather and news. Another two people wanted further enhancements to the search, for example, via including a wider range of defence documents. The remaining two participants wanted a last viewed favourites list or a *"my favourites"*. Four participants identified ease of use and interface issues needing attention. Two people felt the AKD and ADEL were *"too busy",* a third saw these two systems as not having a *"User friendly 'beautiful' look"* and the fourth person criticised the small font size and tab buttons. Three participants raised concerns about information quality, in particular the limited range of document/information types accessed (2) and that the *"Data could be obsolete"*.
- ADEL and the ideal KMS versus the AKD: revealed requirements currently met by ADEL but not provided by the AKD. The three individuals who used the above pairings saw ADEL as *"tested and relatively stable"*, as having a *"good design webpage"* and a better colour.

The AKD questionnaire was completed toward the end of day two with 14 participants providing written comments. Ten people provided comments on usability (GUI, ease of use). Concerns about the look and feel of the portal were raised by seven people, for example, *"Could be better by having less tabs. Retina better and simpler"*. The ease of use of the AKD was viewed as positive by five participants, except for qualifications about the need for the portal to have a "back button" and the cluttered display of the portal getting in the way of starting the search. The functionality offered by the AKD was commented on by five respondents. Three people appreciated the search capabilities offered by Retina, but two others made suggestions for improvement, such as "*[it] could be better by having choices to search with doctrine, lessons etc"* and providing more colour options for the interfaces. Three

participants also saw the AKD as being useful through cutting "down a lot of time" and therefore *"tasks would be done more quickly"*.

4.4.1.2 Patterns of appropriation

During the workshops a range of appropriation choices were made by participants. The portal provided users with the ability to adjust the interface colour scheme (with green the default as shown in Figure 4.1), the size of frames, and the layout of publication lists. This functionality was demonstrated to all of the workshop participants. A few participants adjusted the colour scheme and size of frames during the workshops. Features used by participants also varied. With Retina, some participants used both the thematic folders (left side Figure 4.2) and the search return list (right side), whilst others showed a preference for using one or the other. In addition, participants could choose which of the two AKD components they wished to employ to support tasks. In the 22 questions task, Retina was used to answer the majority of questions. However, there were a few cases where participants showed a preference for locating relevant information via the portal search interface or via the tabular structured interface of the portal. For the second task, which involved the preparation of a brief: seven people continued to use Retina; three people had tried the portal after using Retina, with two preferring the portal and one preferring Retina; and two others tried the portal after previously using Retina but were dissatisfied with the portal.

Associated with system variations were differences in the approaches taken to complete the same task, which provided evidence of practices being adapted in response to technology. Both ADEL and Retina had search functionality, however, with ADEL participants had to wait many seconds or even minutes for returns to be provided. As a result some participants opened up additional windows and entered search terms associated with another question, thereby running multiple searches in parallel, or they gave up and tried a new search term. With Retina, no such behaviour was observed.

The last task completed by participants in the two-day workshops involved the preparation of written feedback for peers on the AKD by groups of two to three individuals (see Appendix B.6). Participants were queried about whether or not they would use the AKD in the future. All participants expressed a clear intention to use the AKD in the future if given the opportunity, for example, one group wrote "*WE WOULD!!!*". Three people responding to the

AKD evaluation questionnaire also indicated they would use the AKD in the future: *"roll it out now, before I get too old and crusty"*.

The repertory grid technique and associated discussions highlighted information quality as something for which the AKD was judged as superior to ADEL. Seven people offered comments about information quality, such as: it *"provides [a] vast range of documents"* and *"gives relevant search returns"*.

4.4.2 Quantitative data analysis

Data were analysed using descriptive and inferential statistics. An analysis was undertaken to identify particular questionnaire measures that the majority of respondents judged as either positive or negative. In addition, inferential statistics determined:

- correlations between influences and various measures of appropriation; and
- performance differences between the AKD and other systems, primarily ADEL, during the experiment.

Cronbach's alphas for all the multi-item measures were calculated and ranged from 0.68 to 0.97 (see Table 4.4 and Table 4.6).

In this section, findings related to participants attributes, extant technologies and practices are presented first. This is followed by analyses to understand participants' evaluations of the AKD, so as to surface influences on and patterns of appropriation.

4.4.2.1 Participant attributes, extant technologies and practices

Previous research has indicated a link between users' appropriations of technologies and their age, gender, knowledge, skills, attitudes toward computers in general, and self-assessments of competence (Clegg et al. 1997). These variables were measured, with knowledge and skills assessed by determining level of education and years of service. Sixty six percent (23/35) of respondents to the pre-workshop and AKD questionnaires indicated year 12 or below, with the remainder having TAFE (3), undergraduate (6) or postgraduate qualifications (3). Respondents' attitudes toward computers in general were quite positive with 62% (23/37) either agreeing or strongly agreeing with the scale items. In addition, 71% (34/48) and 73% (11/15) of respondents respectively judged themselves to be competent users of ADEL and

the AKD. However, none of these variables were significantly correlated with any of the AKD appropriation measures.

The AKD was designed to provide access to doctrinal and lessons related information sources. In the baseline questionnaires respondents were asked how important doctrine is to undertaking the duties of their current appointment. Of the 52 respondents combined, 30 viewed doctrine as being very important to their current appointment with a further 13 viewing it as important (a combined 83%). In the baseline questionnaire only, respondents were also asked about lessons, with 40% (12/30) seeing lessons as important or very important.

Participants were asked to indicate what formats they had accessed doctrine in the past, and to then indicate the percentage of time spent utilising the particular formats. Accessing ADEL via the Defence intranet was the most common format with 48 of 53 respondents utilising this format 40% of the time on average (responses ranged from 5% to 100%). Formal doctrinal publications (n=47, 34% on average) and print outs from ADEL (n=40, 22% on average) were also commonly employed formats. These findings were consistent with use data showing that almost all of the respondents (49/54, 91%) had used ADEL, and were doing so a few times a month or more (71% of users, 35/49). Furthermore, participants had been using ADEL for an average of 5.7 years (n=26, SD =3.2).

4.4.2.2 Influences on appropriation

Influences on the appropriation of the AKD were determined by generating a correlation matrix using pair-wise deletion of missing data, as well as through calculating descriptive statistics. The complete descriptive statistics and correlation matrix are contained in Appendix B.11 and B.12 respectively. Data used in the analysis was sourced from the 15 people who completed the AKD evaluation questionnaire[7] in the workshop. Satisfaction with the ability to search for information using the AKD was significantly correlated (-ve) with the number of items completed during the experiment (see Table 4.3). The ability to search for information, ability to navigate around, usability, usefulness and the future impact of the system were significantly correlated with information quality and intention to use the AKD. In addition, system design was correlated significantly with intention to use the AKD. No significant

[7] The questionnaire did not differentiate between the two AKD prototype components, Retina and the portal.

correlations were found with nature of IS use or with the number of questions completed correctly in the experiment.

	Correct	Completed	Information quality	Intention to use	Nature of IS use
Satisfaction with core functionality					
- search for information	-0.39	-.52*	.57*	.71**	0.09
- cut and paste	0.16	0.09	-0.28	0.20	-0.37
- navigation	0.11	0.04	.53*	.59*	0.13
- customise/personalise	0.31	0.28	0.09	0.21	0.35
Usability	-0.02	-0.09	.75**	.87**	0.05
Ease of use	0.12	-0.02	0.41	0.51	-0.31
Design	-0.01	-0.08	0.46	.73**	0.38
Usefulness	-0.14	-0.28	.72**	.83**	0.22
Demands on users	0.03	0.21	-0.05	-0.25	0.30
Future impact of system	0.11	0.07	.83**	.59*	0.21

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.3 Intercorrelations between influences and measures of appropriation

The descriptive statistics are summarized in Table 4.4. The analysis identified influences that the majority of respondents judged as either positive (%>3) or negative (%<3). This analysis complemented the correlational analysis by providing insights into the valence of users' attitudes toward the AKD. A number of the same measures were also included in the questionnaires used to assess ADEL, thereby assisting in contextualising users' evaluations of the AKD. The results for ADEL are listed alongside those for the AKD in Table 4.4.

Table 4.4 shows that the large majority of participants held positive attitudes about the core functionality offered by the AKD, its usability (including ease of use and system design), and usefulness. They also saw the AKD as placing limited demands on them and held expectations that it would lead to future benefits for the organisation.

	AKD						ADEL	
	Alpha coeff	**Min**	**Max**	**Mean**	**%>3**	**%<3**	**%>3**	**%<3**
Satisfaction with core functionality								
- search for information	-	3	5	4.33	93	0	59	16
- cut and paste	-	3	5	4.60	93	0	49	19
- navigation	-	3	5	4.00	87	0	49	24
- customise/personalise	-	1	4	2.80	27	40	-	-
Usability	0.80	2.78	4.56	3.83	93	7	67	33
Ease of use	0.96	3	5	4.23	93	0	60	17
Design	0.74	2.67	5	3.96	93	7	58	19
Usefulness	0.94	2.40	5	4.09	87	13	54	23
Demands on users	0.80	1.33	4	2.29	13	80	-	-
Competence	0.80	2.25	5	3.53	73	20	71	17
Future impact of system	0.97	4	5	4.71	100	0	-	-

Table 4.4 Descriptive statistics: influences on appropriation - AKD and ADEL

The findings for ADEL (two columns on the right of Table 4.4) show that users were less positively disposed toward this system. Approximately half of respondents were satisfied with the core functionality provided by ADEL, its design and usefulness. In addition 60% or more of participants were positive about usability, and ease of use. However, an item level analysis showed that the one major concern expressed by respondents was a usability item assessing the responsiveness of ADEL with 63% expressing dissatisfaction (%>3 = 15).

4.4.2.3 Patterns of appropriation

In the two-day workshops the 15 participants completed the "feedback on interface designs" questionnaire after being provided with an overview of six different interfaces. Rank ordering of the interfaces is presented in Table 4.5. The aggregated results show that the two AKD components, Retina and the portal were ranked first and third respectively. In contrast, the two systems currently employed in Army ranked fifth and sixth.

Interface	Average rank (n=15)	Overall rank order
Retina	2.29	1
Army Knowledge Online (US system)	3.18	2
AKD portal	3.27	3
Mock-up for AKD portal	3.54	4
Army Knowledge Online	4.10	5
ADEL	4.11	6

Table 4.5 Rank ordering of interfaces

The extent to which the AKD was able to support learning and work practices was assessed during three workshops. This provided an additional means of exploring users' appropriations. Quantitative results were derived from the experiment undertaken during the two-day workshops: completion of two sets of 22 questions. Participants were given 65 minutes for each question set to complete as many questions as possible. An average of 7.8 questions were completed correctly when using the AKD (primarily Retina) compared with 4.7 questions for extant systems (primarily ADEL) (N=14, F=4.02, p=0.066).

The descriptive statistics for measures assessing the appropriation of the AKD are summarized in Table 4.6. The large majority of participants expressed a strong intention to employ the AKD to support their information search and learning needs. Also, a majority of participants saw the AKD as meeting their information needs most of the time (93%). Likewise, a comparison with the results for ADEL showed that the information needs of a majority of respondents were also being met by ADEL (77%). A range of views were expressed about the nature of IS use, that is, the extent to which the participants thought their use of the AKD was different from others (Jain & Kanungo 2005).

	AKD						ADEL	
	Alpha coeff	**Min**	**Max**	**Mean**	**%>3**	**%<3**	**%>3**	**%<3**
Information quality	0.89	2.83	5	4.12	93	7	77	17
Intention to use	0.85	3	5	4.42	93	0	-	-
Nature of IS use	0.81	1.67	4.33	2.96	33	33	-	-

Table 4.6 Descriptive statistics: measures of appropriation - AKD and ADEL

4.5 Contextualising the MTA for the AKD case

The MTA was selected as the foundational theory for this thesis because it covers the entire IT use lifecycle, and it can be contextualised for different technologies, and user cohorts. The contextualisation process involves overlaying context specific influences and patterns onto the generic MTA. To support this process the findings from the qualitative and quantitative analyses first need to be combined and summarised.

4.5.1 Influences on appropriation over time: initial exposure

A technology appropriation perspective posits that users' evaluations of technology and associated appropriation choices unfold over time, and that the influences on peoples' evaluations also vary over time as people adopt, adapt and then incorporate a technology with their practices. The two-day workshops were therefore deliberately structured so as to surface the influences on users' evaluations both prior to, during and after exploring the AKD in various use scenarios. Qualitative findings at the pre-use and initial-use phases are summarised in Table 4.7 below.

Influences	Pre-use	Initial-use
Functionality	✓	✓
Usability		
- ease of use	✓	✓
- look and feel (GUI)	✓ (but Retina preferred to portal)	✓ (Retina) × (Portal – 7 negative)
- performance	Not discussed	✓
Usefulness	Not discussed	~ (3 positive)

✓ = mainly positive; × = mainly negative; ~ = insufficient data

Table 4.7 Influences on appropriation (qualitative): pre-use and initial use

Prior to using the AKD, the majority of participants were positive about system functionality (13), particularly search and cut and paste, and usability, including ease of use (8) and the look and feel of Retina and the portal. However, there was a preference for Retina as it was viewed as simpler, less cluttered and easier to read than the portal. This preference was consistent with dislikes and suggestions for changes, with the look and feel of the portal raised by a few people (3). The same usability and functionality issues were apparent at the end of day two of the workshop; however, there was a greater tendency for participants to have more negative views about the look and feel of the portal (7). There was also the emergence of performance as a usability issue, with the AKD seen to be quicker than ADEL

(13) and the time savings this could potentially deliver to participants back in the workplace (usefulness) (3).

Analysis of the quantitative data from the AKD evaluation questionnaire was largely consistent with the qualitative findings (see Table 4.8). In particular, functionality, usability and usefulness were evaluated as positive by the large majority of respondents. In addition, attitudes toward computers in general, competence, demands placed on users by the AKD, and their views on the future consequences of Defence implementing this system were also viewed as positive by the majority.

Influences	Inferential statistics	Descriptive statistics
General attitudes	~	✓ (73%)
Competence	~	✓ (73%)
Functionality		
- search for information	Information quality (*); Intention to use (**); Questions completed (*-ve)	✓ (93%)
- cut and paste	~	✓ (93%)
- navigation	Information quality (*); Intention to use (*)	✓ (87%)
- customise/personalise	~	~
Usability		
-Look and feel (GUI), performance, navigation	Information quality (**); Intention to use (**)	✓ (93%)
-Ease of use	~	✓ (93%)
-Design	Intention to use (**)	✓ (93%)
Usefulness	Information quality (**); Intention to use (**)	✓ (87%)
Demands on users	~	✓ (80%)
Future impact of system	Information quality (**); Intention to use (**)	✓ (100%)

✓ = mainly positive; × = mainly negative; ~ = not significant or insufficient data
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
-ve = Negative correlation

Table 4.8 Influences on appropriation (quantitative): initial use

A correlation analysis was undertaken so as to identify statistically significant influences on various measures of appropriation (see Table 4.8). Findings from the correlation analysis suggest that users who favourably judged the functionality, usability, usefulness and future impact of the system also expressed strong future use intentions and viewed the AKD as providing good quality information. The search functionality offered by the AKD was negatively correlated with the number of items completed during the experiment. This implies that participants who particularly liked the search functionality did not complete as many questions. However, the result was not significant for the number of questions completed correctly, which suggests caution in drawing any firm conclusions from this result.

4.5.2 Patterns of appropriation over time: initial exposure

Participants rank ordered six different interfaces on day one and provided an assessment of their future use intentions on day two. A comparison of the results from these two sources suggests that participants' appropriation intentions for the two AKD components were maintained after two days of intensive use. Upon first presentation, Retina and the portal were ranked first and third respectively, and at the end of the workshop most participants (93%) consistently expressed an intention to use the AKD in the future (see Table 4.9). The same proportion of participants also valued the quality of information provided by the AKD. Participants' views varied with respect to how different they believed their use of the AKD was from others.

Appropriation measures	**Pre-use (P); Initial-use (I)**
Quantitative	
Ranking of 6 interfaces	Retina 1st, Portal 3rd (P)
Intentions	✓ (93%) (I)
Information quality	✓ (93%) (I)
Nature of IS use	✓/× (33%, 33%) (I)
Number of questions completed correctly	AKD average =7.8 questions (I) ADEL average = 4.7 questions
Qualitative	
Personalisation	Yes – a few (I)
Features used varied	Yes – Retina (thematic folders, search return list, both) (I)
AKD components used to support tasks varied	Yes – Retina used by majority, but some also tried portal (I)
Approach to tasks	Retina search – serial (I) ADEL search – parallel (I)
Intentions	✓ (100%) (I)
Information quality	✓ (50%) (I)

✓ = mainly positive; × = mainly negative; ✓/× = mixed

Table 4.9 Patterns of appropriation: pre-use and initial use

A range of appropriation patterns were observed over the two day workshops (see Table 4.9): personalisation of the interface through changes to the colour scheme and frame sizes; variation across individuals in the features and AKD components used to support tasks; and differences in approaches taken to complete the task between ADEL and the AKD. The AKD was also more efficient than ADEL in helping users complete an information search task. In addition, participants all clearly articulated an intention to employ the AKD if given the opportunity in the future. Furthermore, half of the participants who provided written comments (7/14) wrote positive comments about the quality of information provided by the AKD.

4.5.3 The MTA contextualised for the AKD case

The MTA was contextualised to address the findings from the AKD case (see Figure 4.4). This case provided coverage of the initial exposure phase, which was decomposed into pre-use and initial use. Contextualisation was achieved by overlaying context specific influences and patterns onto the generic MTA, which are contained in the boxes surrounding the generic model. The contextualised model summarises the qualitative and quantitative analyses from the AKD case under four key headings: influences on appropriation preferences (pre-use), appropriation preferences (pre-use), influences on appropriation (initial use), and patterns of appropriation (initial use). The ticks '✓' indicate that responses were mainly positive, with the crosses '✗' indicating mainly negative. The numbers in brackets denote particular measures of appropriation with which particular influence measures were significantly correlated.

A summary of influences on and patterns of appropriation prior to use is presented in the bottom left box of Figure 4.4 below (pre-use): functionality and usability of the AKD were judged as positive ('✓'), and the AKD ranked higher than similar systems. Influences and patterns after a period of initial use are summarised in the boxes at the top of the figure: for example, the ability to search for information was significantly correlated with intention to use '(1)' and with information quality '(2)' (top left box). Furthermore, participants expressed a strong intention to use the AKD (centre top box). These influences and patterns taken together suggest that users' level one evaluations would have translated into a decision by them to adopt the AKD. There was no opportunity to test this proposition since in 2009 Army made the decision to not progress with acquiring the search engine due to issues unrelated to the capabilities of the AKD.

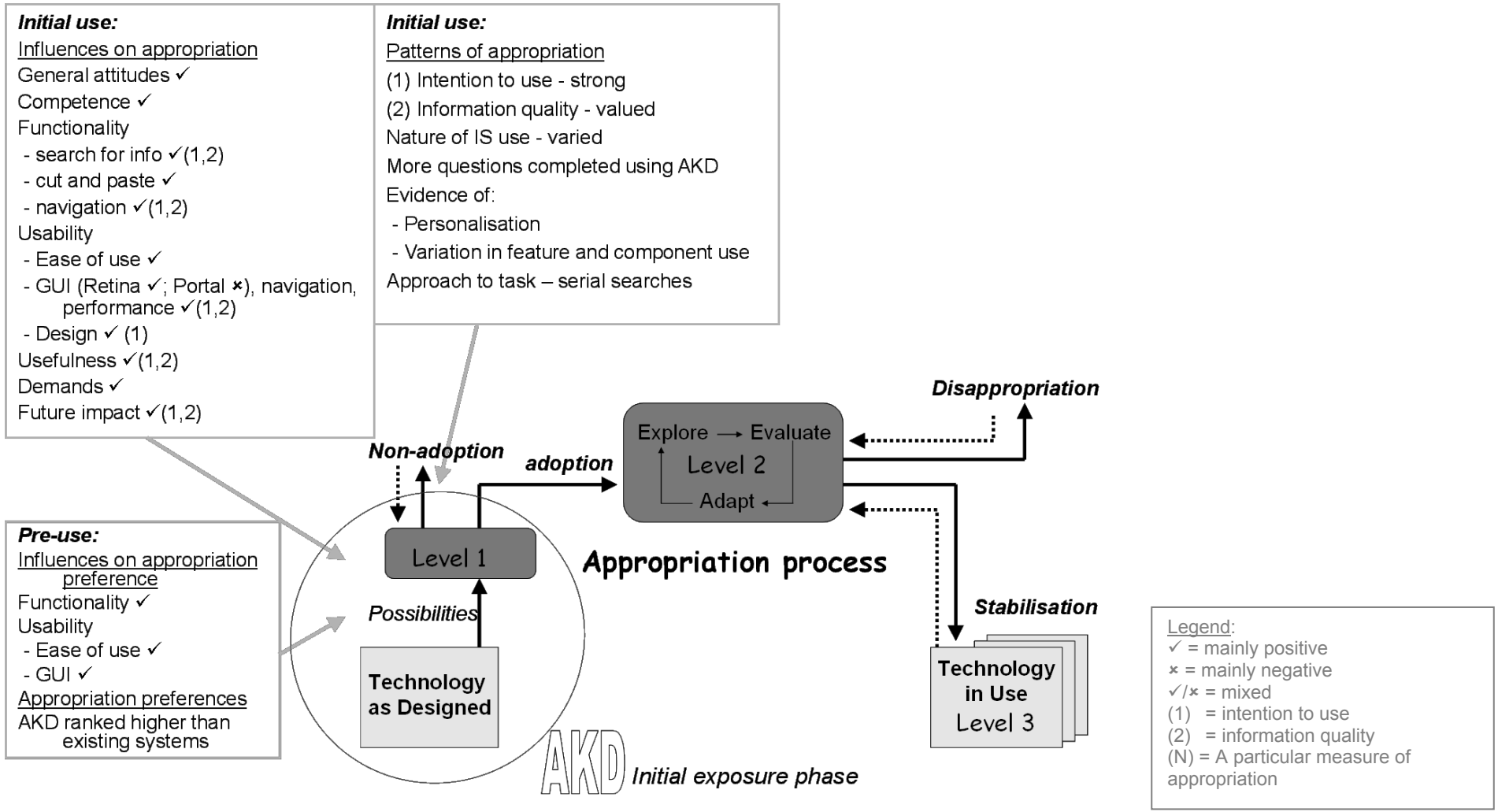


Figure 4.4 The MTA contextualised for the AKD case

4.6 Generative mechanisms

One of the limitations of the MTA is that its explanatory power is constrained due to the dominance of the lifecycle perspective of appropriation. From this perspective, appropriation moves through a series of phases, from initial exposure to adoption through adaptation to incorporation. Such a view helps to describe the process of appropriation but is of limited use in explaining why particular influences and patterns are manifested, as well as the reasons for transitions from one phase of appropriation to the next. Other mechanisms have been identified that provide alternative views of the motors of change underpinning the process of appropriation: teleology, dialectics and evolution (see Chapter 2, section 2.4). The results from this case will now be examined through the lens of each of the four generative mechanisms.

4.6.1 Lifecycle

This case study was focussed on the initial exposure phase of the MTA, which begins with users being presented with the 'technology as designed'. The AKD presents users with a variety of possibilities for conducting a range of information related tasks. A variety of influences is posited to shape users' evaluations and decisions whether or not to adopt the technology. In this case a more fine-grained assessment of initial exposure was undertaken by evaluating influences and patterns prior to use and following initial use (Bhattacherjee & Premkumar 2004). This distinction between pre-use and initial use is not made in the MTA. This is potentially problematic since it is unclear whether or not use of a technology is a necessary part of the initial exposure phase of the MTA.

Adoption or non-adoption was not assessed, since the AKD was not implemented in the workplace. Prior to adoption, users are initially exposed to a technology, which perhaps involves a short period of use (Carroll et al. 2003a). Despite such use, the MTA appears to imply that appropriation choices only begin at the point of the adoption decision. This is consistent with much of the research on technology adoption and use, which distinguishes between pre-adoption activities, the decision to adopt and then initial use (Jasperson et al. 2005). However, this case revealed an indicator of possible adoption prior to use (rankings), various patterns of appropriation after initial use, as well as clear intentions to adopt the AKD if it were provided in the workplace. These preferences and patterns were identified even

though adoption had not occurred. Initial exposure to a technology not only leads to adoption or non-adoption, but also entails active appropriation and formation of adoption intentions. Furthermore, there was clear evidence of adaptation, in particular, personalisation and variation in the features and components used. In the MTA, such adaptation is only seen to occur after the decision to adopt a technology.

4.6.2 Teleology

A teleological perspective frames change as being driven by the purposeful pursuit of goals (Van de Ven & Poole 1995). When applied to the IT domain, users or organisations would be seen as acting as intentional agents who work to achieve the fulfilment of their goals, whether it is to minimise use of a system that is frustrating for users or deciding, at an organisational level, to purchase a new system to address inadequacies of an existing system. The results from this case supported exploration of individual and organisational intentionality, thereby providing a multilevel assessment of teleology.

Much of the theory associated with quantitative survey based research is underpinned by cognitive-rational theory that assumes change is driven by the intentionality of users, with users' intentions being informed by their beliefs and attitudes toward the technology of interest (Pfeffer 1982). In this case, influences on intentions to use the AKD included: satisfaction with specific functionality offered by the AKD; usability; usefulness, and future impact. Participants were also observed to act as intentional agents, for example, when they made choices to change the colour scheme driven by dissatisfaction with the default "*Kermit the frog*" green of the portal.

The cognitive-rational literature has been criticised for neglecting context (Jasperson et al. 2005; Pfeffer 1982). A critical element of context when reflecting on intentionality in organisations is the intentionality that operates at the organisational level, that is, the decision by key actors in the organisation to acquire a piece of technology, or run a trial to evaluate a candidate technology (Jasperson et al. 2005). In this case, key actors determined that information sources were overly stove-piped and that legacy systems were not adequately supporting learning and knowledge practices. As a consequence, a decision was made to establish an Army knowledge domain, with the first phase involving the trial of a candidate technology, the AKD prototype.

4.6.3 Dialectics

Dialectics encompasses a logic of opposition, of contradiction and tension between the thesis and antithesis (Robey & Boudreau 1999; Van de Ven & Poole 1995). It serves as a counterpoint to the logic of determinism typified by the cognitive-rational perspective (Robey & Boudreau 1999). Similar to Cho et al. (Cho et al. 2007), the current study analyses contradictions or tensions at two levels: (1) the artefact; (2) user practices and associated technology.

The AKD was composed of two components, the portal and Retina. Each provided users with the ability to search for information held on multiple repositories. However, they had different design philosophies. From a dialectic perspective, accessing information via the portal represented the thesis and access via the Retina the antithesis. When the thesis and antithesis are brought together there are three possible outcomes: maintenance of the thesis, substitution of the thesis with the antithesis, or a synthesis of the two. In this case, all three outcomes were observed with participants choosing Retina, or the portal or both. Nevertheless, it was the antithesis, Retina, which largely held sway.

At the time of the trial, ADEL was the corporately endorsed source for doctrinal information. It was therefore an important reference point for personnel who required access to doctrine to support their learning or knowledge work needs. ADEL represented the thesis, the status quo. The introduction of the AKD to participants of the trial presented them with the antithesis, an alternative system which had the potential to replace ADEL. During the workshops, users' showed a marked preference for the AKD, including strong indications of intent to adopt if given the opportunity. This suggested that substitution of the thesis (ADEL) with the antithesis (AKD) would have been the most likely outcome following system implementation.

4.6.4 Evolution

Evolution theory is typified by variation, selection and retention. Variation comes about due to random or unpredictable changes or events. One such event in this case was the problem experienced by the in-house development team in integrating the Autonomy search engine with the portal interface. Because of this, the decision was made to provide workshop participants with access to the search engine via Retina, the COTS search interface developed

by Autonomy. Selection results from competition for scarce resources, in this case, the time and effort required to find relevant information. The findings from the workshop demonstrated that Retina was more efficient than ADEL and was selected as the preferred system by workshop participants. Retention serves to counteract the drive to change that comes from variation and selection. It represents the inertia associated with the extant systems, primarily ADEL. In the confines of the workshops, change dominated persistence. External to the workshop, ADEL maintained its inertia.

4.7 Summary

During initial exposure to the AKD, why did users' appropriations vary? Variation in users' appropriations was shaped by system functionality, usability, usefulness, and future impact (see Figure 4.4). Furthermore, even though exposure to the AKD was quite limited, there was evidence of changes in influences over time, with concerns about the portal GUI more salient after use, and performance emerging as a usability issues. User's appropriations also varied with evidence of personalisation, and differences in features and components used to support task completion. There was some consistency in users' future use intentions, and their evaluations of system information quality, with the majority of respondents holding positive views.

Viewing the results through the lens of each of the four generative mechanisms drew out additional insights:

- Lifecycle: A more nuanced view of the initial exposure phase of the MTA, through separating pre-use and initial use, identified that variation in influences and patterns of appropriation can occur prior to an adoption decision.
- Teleology: Intentionality and associated influences assisted in understanding the process of appropriation in this case. Furthermore, intentionality was seen to operate at both the individual and organisational levels.
- Dialectics: Employing a logic of opposition assisted in drawing out the tensions associated with comparative technology evaluations. Tensions existed between the two components of the AKD, and between ADEL and the AKD. This dialectic view also clarified the range of possible outcomes from such tensions: maintenance, substitution and synthesis.
- Evolution: An evolutionary lens brought into relief the importance of attending to the unintended and unplanned events associated with system development, in this case,

difficulties with integrating the Autonomy search engine. This lens also highlighted the value of considering the resources, particularly time, available to users in completing tasks, and the role of technology in either supporting or undermining their efforts.

Chapter 5: The electronic document management system case

5.1 Introduction

The Electronic Document Management System (EDMS) was designed to support document and information management. The EDMS was introduced into three Defence headquarters (HQ). Data were collected following the introduction of the system, with users exposed to the system for between one month and 16 months. These data enabled investigation of the adoption decision and adaptation phase of the appropriation process, as well as the associated context within which the EDMS was embedded. The research questions addressed by this case are:

- Following the introduction of the EDMS, why did users' appropriations vary?
    - What are the influences on appropriation of the EDMS in the context of document and information management practices in Defence ?
    - What are the patterns of appropriation of the EDMS in the context of document and information management practices in Defence HQs?

The above questions are contextualised variants of the research questions described in Chapter 3. They have been made specific to a particular phase of the appropriation process (introduction: adoption and adaptation), a particular technology (EDMS), particular practices (document and information management), and a particular context (Defence HQs). Being specific in this way is consistent with the intent to refine and develop theory about appropriation, building on a model that attends to context, the MTA.

In this chapter the EDMS case is outlined by describing the organisational context, as well as practices and technologies associated with document and information management in Defence HQs. The research methodology is explained. The qualitative and quantitative results are presented, which, together with the case description, are used to contextualise the MTA for the EDMS case. The findings are then examined through each of the four generative mechanisms.

5.2 Case description

5.2.1 The organisational context

The three HQs in this case were responsible for planning and allocating resources for military operations, as well as the command and control of operations. HQ personnel were drawn from all three military services (Navy, Air Force and Army), as well as from the public sector. While a minority of personnel had been with the HQs for many years, the majority were in the process of completing a posting of approximately two years in length. Because of this posting cycle it was not uncommon for 50% or more of the personnel in a HQ to change in a 12 month period, with much of the change-over of staff occurring during the months December through February.

Another important feature of these HQs was the sensitivity of information to which personnel had access. As a result, the various branches were to some extent necessarily stove-piped.

Prior to the introduction of networked computer systems, the HQs had formal organisational structures and processes that largely ensured effective management of documents such as reports, faxes, minutes, and other forms of correspondence. Dedicated personnel, referred to as registry staff, managed these documents, thereby facilitating awareness and management of information. With the introduction of networked computer systems and the capacity to rapidly distribute information, for example via e-mail, the conduct of business increasingly came to rely on informal communication and ad hoc processes. The HQs maintained the formal organisational structures and processes for records management (the registry function); however, these were not designed to handle the massive increase in the volume and type of information created. As a consequence, there were two different document management systems in place: the formal structures and manual processes designed and implemented prior to computerisation; and the informal communications and document management practices that emerged in response to widespread availability and use of applications such as e-mail.

5.2.2 Document management

In 2003-4, HQ personnel were producing, disseminating and storing both paper and electronic documents. Reports and documents of corporate significance were still stored and managed by the registry function within the HQs. People also kept local paper copies of documents for

their own records, because this was seen to be more efficient than sourcing the information through the registry function. Important correspondence, including emails was also retained on file in paper form – by printing out the emails and attaching them to the relevant file. However, much of the email traffic was not stored in this way. The registry function was well placed to service information requests from HQ staff, higher level HQs and from government, and was also suited to readily satisfying legislative requirements, such as the Archives Act. However, the informal communications and document management practices were not covered by the registry function and so could not satisfy legislative requirements in a timely fashion.

Documents were created using a variety of software applications, such as MS Office, and Lotus Notes mail. These documents were stored electronically on network drives (home and group) and databases. Individuals also stored documents locally on their home drive using file structures of their own making. Documents in group drives were structured in a logical fashion but the logic was often confined to a particular branch of a HQ. This made it difficult for new personnel, and those personnel from other parts of the HQ, to make sense of the file structure and find files that they had not filed. As a consequence, information was not readily shared, thereby contributing to a loss of corporate knowledge.

Many of the documents required input from multiple personnel. This was often achieved using e-mail with the document attached. However, the process for managing and coordinating the various inputs, and maintaining effective version control, was left to the originating author.

E-mails were central to the conduct of business in these HQs. It was not uncommon for some people to receive over 100 emails per day. The sorting, reading, and creation of e-mails therefore occupied a significant amount of people's time. Nevertheless, little guidance had been provided on the appropriate procedures for managing e-mails. People tended to develop their own folder structure within the Lotus Notes application to manage and store their e-mails. These e-mails were generally only accessible to those people associated with the particular correspondence, even though the information stored could be of use to others. Documents or correspondence were often sent via e-mail with the paper copy following later. This enabled the information to be attended to sooner, but it introduced duplication.

Some attempts had been made to introduce computer-based information systems to help manage the plethora of information. For example, an intranet was used for sharing information within the HQs. Branches posted information onto their website that was considered relevant for other branches. In some cases, personnel sent e-mails with web links to a document stored on the intranet rather than attach a document. The registry staff employed an electronic records management system to assist in creating and locating paper-based files. But, as mentioned previously, this information was often not called upon by personnel due to the time taken to obtain relevant information. Instead, personnel maintained local copies of information they believed would be required again.

The management of both electronic and paper documents had reached a point where many personnel were experiencing information overload, corporate memory was being undermined and there were difficulties in satisfying legislative requirements in relation to archiving.

In response to these shortcomings, an initiative was put in place to introduce a document and records management system. An initial scoping study was completed in 2000. This study concluded that an electronic document and records management system was required, and that a records management tool already in use by registry staff had the required functionality to satisfy the requirements. In 2001, an additional study was undertaken to review, confirm and verify the requirements. However, no formal problem analysis was undertaken prior to identifying a computer-based solution to address deficiencies in document management. Instead, the extant records management tool was used to guide the identification of most of the required functionality.

5.2.3 The technology – an electronic document management system

The electronic document management system (EDMS) solution chosen was designed to support:

- management of electronic and physical correspondence (e-mails, faxes, minutes, and so on);
- scanning and management of paper documents;
- collaborative document development and version control;
- electronic document sharing;
- file management; and

- web authoring and publishing.

From a process perspective, the particular EDMS was designed to support the entire document life cycle of both electronic and physical documents. The lifecycle starts with the creation of a document and ends with its disposal. Intervening steps in the lifecycle include drafting, registration, document tracking, workflow management, version control and distribution control.

The EDMS was deployed onto the existing technology infrastructure, a wide area network supported by Windows NT based servers and desktop machines with the Window NT operating system. At the application layer, the system integrated with the MS Office applications, but modifications were required to integrate with the existing Lotus mail application.

5.2.4 Implementing the EDMS

5.2.4.1 Background

The move to the EDMS represented a significant change in business practices and culture. Creating and modifying documents was a core part of the business of the organisation. Introducing a system that could improve document management therefore introduced the potential for significant efficiency gains through improved location and retrieval of information, but also introduced a significant risk related to moving from the old business practices to the new. For individuals it introduced a significant additional overhead relating to increasing the number of steps to create and modify documents, particularly the requirement to provide metadata[8], as well as the impost of naming conventions and file structures associated with new information management policies. Collectively the culture needed to change from one where document and records management was largely peripheral to the daily work practices of personnel to one where it was central to the creation, modification and management of documents; a shift from a culture of many isolated silos of information, to one where information was centrally stored and readily available.

[8] Metadata is defined as "structured information that is created specifically to describe another resource. It provides basic information such as the author, the date of creation and the subject matter of the item described. Metadata can be compared to a library catalogue record that facilitates discovery of a particular work by providing information such as title, author, publisher, subject, description of the work, location, etc"(Australian Government Information Management Office 2004: 3)

To help manage the risk associated with implementing the new system, it was recommended in the requirements document to undertake a pilot implementation of the system, assess whether the pilot was successful, and then bid for additional funds to roll the system out across the rest of the organisation. In addition, a range of training, support, business process, change management and data migration requirements were also outlined in the requirements document. The need for contingency plans for rollback to previous practices was also made explicit. However, the perception of many of the stakeholders involved in managing or supporting the pilot (project staff, embedded HQ IS management and support personnel, and corporate IS staff) was that the system was 'fit for purpose' and would be quickly rolled out into the rest of the organisation.

Three HQs were selected to participate in a pilot implementation of the EDMS. Personnel were given half a day of mandatory training before being certified to use the system and being granted access privileges. In addition, this was followed up by business support officers sitting down with staff to assist them in using the system in the context of their particular workgroup and practices. Electronic records stored on network drives were migrated across to the EDMS. A roll back plan was considered in the early stages of the pilot, however it was decided that maintaining a parallel file storage environment was not sustainable.

The deployment of the EDMS at the three HQs occurred from October 2002 through to September 2003. The rollout was staggered across the three HQs with HQ1 receiving it first followed by HQ2 and 3.

5.2.4.2 Evaluation

A project was established to manage the acquisition and pilot implementation of the EDMS. This project resided in a part of Defence responsible for acquiring and sustaining equipment to support the military. An evaluation of project outcomes was undertaken by the researcher with the support of key IS stakeholders in each HQ. These personnel assisted with distributing and collecting questionnaires, as well as conducting some interviews. The data for this EDMS case draws on the data collected from this evaluation, as well as subsequent data collection activities.

5.3 Research methodology

5.3.1 Participant characteristics

Participants were primarily drawn from the three HQs, but also included potential users of the system from an additional HQ that was awaiting the system. The 134 participants represented a cross-section of personnel based on HQ, branch membership and rank. In addition, staff involved in managing or supporting the implementation of the system were included so as to obtain the perspectives of different stakeholder groups (Owen & Rogers 1999). Data collection occurred from August 2003 to August 2008 and was divided into two phases, an initial phase and follow up phase, with 13 people contributing data to both phases.

In the initial phase, data were collected from 102 people between August and December 2003. Eighty of these people contributed information about their perceptions of EDMS and their patterns of use, representing 32% of the user population (n=253) from the three HQs[9]. The EDMS users ranged in rank from Corporal (Equivalent)[10] (CPL(E)) to Colonel (E) (COL(E)), and were drawn from the Army, Navy and Air Force, Defence civilian employees, and from most of the branches at the three HQs. All participants provided information on the personal, technical and organizational context.

A follow up evaluation was undertaken in March 2004 with 45 people. Thirty four users provided information about EDMS, representing 13% of the population from the three HQs[11]. Users again ranged in rank from CPL(E) to COL(E) with a similar cross section of personnel types and branches to the initial phase. All participants provided contextual information. Follow-up enquiries were undertaken in 2006 and 2008 with five people to determine the status of EDMS.

[9] In HQ1 41% of personnel were represented, 17% in HQ2, and 44% in HQ3.
[10] The participants for this study were drawn from all three services and from the public sector. As a consequence, the range of ways to describe ranks was quite large. For example, the Air Force and Navy employ different rank designations than Army for many ranks. Therefore "equivalent" is employed to mean that the participants held a rank equivalent to that of the rank designators used in the Australian Army.
[11] HQ1 again had 41% of personnel represented, 3% in HQ2 and 16% in HQ3.

5.3.2 Research foci and methods employed

Data on EDMS were collected following the introduction of the system, with users exposed to the system for between one month and 16 months. This enabled investigation of the adoption decision and the adaptation phase of the appropriation process (see Figure 5.1).

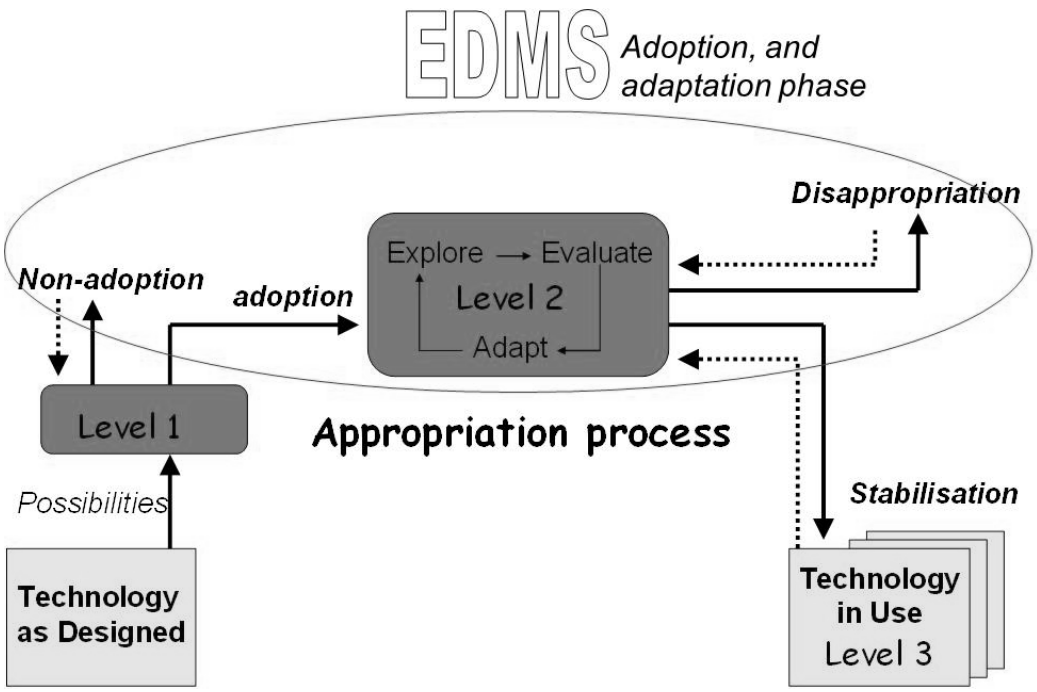


Figure 5.1 Mapping of EDMS case to the MTA

The EDMS was investigated using multiple methods as described below and summarised in Table 5.1. Two types of interviews were employed: repertory grid and semi-structured. Interviews were conducted using the repertory grid technique (see Appendix C.3), with the three pre-defined elements being: 'previous IM [information management] practices', 'IM using EDMS' and 'Ideal IM practices'. Semi-structured interviews were also used to derive background and contextual information from key stakeholders relating to their roles, measures of success for the project, and influences on the system's implementation (see Appendix C.4). Data about the context, including the historical context leading up to the implementation of the EDMS, were also derived from discussions and documents

The questionnaires for the initial and follow-up phase used a combination of Likert-type rating scale questions and space for written comments to elicit a range of user perceptions related to EDMS (see Table 5.1 and Appendix C.1 and C.2). In addition, one set of items was derived from the user requirement document. It listed a range of tasks and document

management capabilities that captured desired business impacts, such as the ability to store and manage e-mails, to assess if users agreed that EDMS had led to improvements in these areas. Personnel in HQ3 completed an additional questionnaire, which similarly assessed whether improvements in a variety of document management activities had occurred. It also assessed the overall impact of EDMS on information management and business practices, the adequacy of training and support, and the use of specific system functionality (see Appendix C.1). The follow-up questionnaire differed from the initial one by replacing the generic measure of frequency of use with finer grained measures designed to assess document storage and management behaviours and the particular activities supported by the EDMS (see Table 5.1 and Appendix C.2).

Information about the status of the system was elicited in 2006 and 2008 with five personnel who were associated with the system. These enquiries were undertaken primarily via telephone and e-mail, but in addition, one interview was conducted in 2008.

Research foci	**Method:** **- description**	**Issues assessed**
Influences on appropriation	Questionnaire:	Business impact; Training and system support; Procedures and guidelines (initial only); Usability (inc. ease of use); System design (initial only); Demands on users (initial only); Usefulness; Future expectations (org.) (initial only); Competence
	HQ3 Questionnaire: initial phase only	Improvements in document management activities; Impact on IM and business practices; Adequacy of training and support;
	Interview: repertory grid	IM using EDMS compared/contrasted with previous IM practices and ideal IM practices
Patterns of appropriation	Questionnaire	Length of use; Frequency of use (general) (initial only) Frequency of use (specific – follow up only) - store/management docs - perform practices
	HQ3 Questionnaire: initial phase only	Use of specific system functionality
	Interview: repertory grid	IM using EDMS compared/contrasted with previous IM practices and ideal IM practices

Table 5.1 Research foci, methods and issues assessed

5.4 Results

The data were used to identify influences on appropriation, appropriation patterns, and how influences and appropriation patterns changed over time. Analyses relating to influences and appropriation patterns independent of time were considered first so as to surface general themes and issues. The data were then analysed from a temporal perspective. The introduction of EDMS was staggered across the three HQs. In addition, due to the posting cycle in the military, staff turnover at each HQ was high. Questionnaire respondents from the initial and follow-up phases therefore had access to the EDMS for different periods of time. This provided two cross-sectional data sets of users' appropriations of the EDMS and the influences that shaped these appropriations following different periods of exposure to the system. Furthermore, comparisons between the initial and follow-up questionnaire data identified changes in user appropriations and influences over time. These data were qualitative and quantitative. Analyses based on the qualitative data are presented first.

5.4.1 Qualitative data analyses

Qualitative data consisted of written comments from questionnaires, field notes taken during interviews and discussions, as well as a range of different documentation and records of correspondence. Where possible, interview data and discussions were audio recorded, after first receiving the consent of participants. The audio recordings augmented the field notes, rather than being transcribed in full. Themes were identified as described in the analyses below. Influences on appropriation are presented first, followed by patterns of appropriation. Changes in influences and patterns over time are then considered.

5.4.1.1 Influences on appropriation

Usability of the EDMS, which included ease of use and system design, attracted the most comments from questionnaire respondents and interviewees. Forty percent (40/101[12]) of participants provided comments about usability issues. Almost exclusively these comments were criticisms. Many of the comments (30) related to the intuitiveness or ease of use of

[12] 40 responses (initial = 32, follow-up = 17, both phases = 9) out of a total of 101 participants (initial = 80, follow-up = 34, both phases =13)
Initial phase: twenty eight users of EDMS and associated support personnel were interviewed, and 55 questionnaires were returned by users. However, 15 people contributed to both interviews and questionnaires. Therefore the total number was (28+55)-15 = 68.

EDMS. Of these participants, 21 made explicit reference to the lack of intuitiveness of EDMS: *"the system is un-Windows like"*. The remaining participants made comments about related issues such as poor ease of use, complexity of the system, lack of familiarity and difficulty in learning how to use the system: "*common tasks…take far too many keystrokes and windows. People who are not computing 'enthusiasts' can find these systems daunting."* Such comments also ranged across various components of EDMS including: the e-mail interface, editing, searching, the user interface in general, the use of double click and right click on the mouse, saving and storing, the lack of scroll wheel functionality, and navigation. Intuitiveness is a subjective construct, but in this context it was informed by users having familiarity, both at work and at home, with Microsoft applications and their interfaces and navigation logic. As a consequence, participant perceived EDMS to be *"..very user unfriendly. It is dangerous. You have to unlearn previously learnt behaviour. This requires a culture shift. The military are pretty bad at this"* and *"The application should be Windows based, even with my experience I find I often get things wrong, ie opening documents."* This lack of intuitiveness was tied to the design of the system:

- its use of Twisties, little triangles to the left of a file/folder name that are used to expand or contract the file/folder; and
- opening a document for editing requiring the use of the mouse right click rather than the "normal" MS double left click.

System performance and reliability were other usability issues of concern to many participants. Twenty five people expressed concerns about the slow response times of EDMS. These concerns related to system response times in general, logging in to EDMS, accessing files, opening documents, saving documents, and searching. For example, *"EDMS can be painfully slow to open documents"*, and *"Searching is slow and cumbersome…Ideally, searching would be very fast, akin to an Internet search engine."* The reliability and availability of EDMS was a concern for six participants: *"with EDMS we have had…system outages, and … people have suffered a loss of documents and a loss of work"*.

The impact of EDMS on user's productivity and performance was raised by 35 participants, and categorised by drawing on the Davis (1989) construct of perceived usefulness. Twelve participants offered views on how EDMS had led to time savings, improved ability to access information, and easier work performance. Registry personnel were particularly positive about the system, citing improvements in the management of paper and electronic files. Three

people saw EDMS as having great promise: *"in time…EDMS will become a great tool"*. One person was neutral, preferring to delay judgement until reasonable standard operating procedures (SOPs) were developed. The remainder of participants (19) held negative perceptions of the impact of EDMS. These perceptions included EDMS being more time consuming than previous information management practices leading to reduced productivity, the impost of additional steps without a benefit, and it being an imposition. "*EDMS has not improved any aspect of my job-related activity"* and *"It represents more of an administrative overhead than a benefit"*.

EDMS was deployed into the three HQs at different times, and each HQ varied with respect to implementation practices. The above findings were therefore analysed to see if location had a bearing on perceptions toward EDMS. HQ1 was most favourably disposed toward EDMS, followed by HQ3 and HQ2.

A variety of change management strategies were developed to support the implementation of the EDMS and to encourage staff to use the new system. However, an analysis of comments from a wide range of participants suggested that much work remained to be done to encourage use. In particular, of the 33 people that provided comments that related to change management issues, 31 expressed concerns, and five made positive comments.[13] In terms of negative comments, five people indicated that there was a failing at HQ2 and HQ3 in terms of introducing EDMS at around the same time as information management processes and practices were being changed. As one person put it, the *"process was flawed from the perspective that they went for too big a change at one time. Change business practices, implement system, train people up and change the whole structure of storage in one go."* The introduction of EDMS represented a fundamental shift in thinking about how information and documents were managed. It was therefore felt that more work should have been done to prepare the sites for the change in processes and culture before EDMS was deployed. On a positive note, a few respondents from HQ2 offered the opinion that EDMS had been a stimulus to paying much needed attention to information management issues in the HQ; *"a shift to actual information management is a quantum leap for Defence and is essential. EDMS has started us on this path*". However, associated with such comments were arguments to the

[13] The total is more than 33 as some people provided both positive and negative comments.

effect that *"the improved information management processes brought in to support EDMS are positive, but we did not need EDMS to achieve this"*.

Training was a central element of the change management approach. Seventeen people provided comments about training, with 12 people providing negative comments and five providing positive responses. The negative comments related to a perceived lack of training, the training not being framed in the context of how a site conducts its business, and a failure to effectively communicate the philosophy behind the introduction of EDMS. As one respondent from HQ3 stated *"the major problem with the formal training was that it was given prior to the creation of usage SOPs, therefore the training did not necessarily match workflows."* In terms of positives, the training was seen as okay or good.

Structural implications of moving toward explicit management of information supported by EDMS were noted. Two people from HQ1 and HQ2 suggested that senior personnel needed to be more directly involved in information management at a site, rather than residing within the communications and information systems area, as information and document management was fundamental to the business of the sites.

The user requirements document included desired business impacts from implementing EDMS. Participants provided comments on many of these requirements.

- In relation to search and retrieval of information, eleven people commented favourably, for example, *"EDMS provides an excellent search tool for documents"* and EDMS provides *"a decent search function, which allows you to search on more than just name, date created."* However, three people indicated it was difficult to find documents, and pointed to a lack of training, system usability, and inappropriate system set up to explain why. People also commented on the ability of EDMS to support information retrieval, with three people pointing to the value of having all information stored in a single repository.
- Thirteen people offered their views on the version control functionality in EDMS. While the comments were generally positive, a few people attached caveats to their responses such as *"there is a risk of corrupting the versioning system in EDMS by erroneously adding in changed versions of documents received back from email recipients."*
- The EDMS was a pilot implementation. It was therefore understood that document exchange with non-EDMS sites would continue to require use of e-mail and the intranet,

but that document exchange between EDMS sites should be enhanced. Three people concurred with the latter, but indicated that it would take time to become familiar with such a capability. However, there were concerns from three other participants that document exchange between EDMS and non-EDMS sites was less than effective.

5.4.1.2 Patterns of appropriation

The analysis of users' appropriations of the EDMS was firstly organised around core activities supported by the tool. Use of EDMS to create documents was an important activity since a lack of widespread use would undermine the utility of the system as a single repository of corporate information. At one of the HQ it was reported that the executive staff were not directly using the EDMS. They continued to make hand-written changes to documents, rather than electronically editing the document stored in EDMS. Support staff then scanned the hand-edited documents into the system. Five people indicated they minimised or bypassed use of the system. Two of these people explained that their limited use of EDMS related to the nature of their roles, which required access to different systems for storing and managing documents. The other three people were endeavouring to maintain their existing and familiar processes: *"guess it boils down to a lack of use/comfort/familiarity/ways of getting around it"*.

Thirteen people commented on the appropriations of others, with six people indicating that they were aware of some people in their organisations that were still utilising their home network directories and actively bypassing EDMS. An additional four people indicated some of their colleagues were maintaining paper based work approaches in preference to use of EDMS: *"I find staff tending to draft doc's for signature by [the] branch head…printing [it] out and forwarding with comments attached on notepaper"* and *"[there are] people producing signed off hard copy documents but the document isn't in EDMS"*. As a result, registry staff were being called on to scan in these documents so others could access them. Such behaviour was also perceived as undermining confidence in collaborative work practices: *"I am not confident that work on various issues is coordinated. I can commence action on an electronic version of a document and then find a paper version with other direction written on it."* An additional observation of others was that people were not *"exploiting the capability [to] dump e-mails that are of corporate value on file"*. The views of an IS support person, and a representative from the contractor responsible for the technical integration of the system, were that people accepted it. The remaining comments related to the

need to adapt the system *"once it is in place"* but the capacity to do so was undermined by *"Defence…not [having] the ability to do modifications [to the interface] themselves"*.

A HQ3 interviewee indicated that EDMS "captures email transactions to file, [where as previously] email had to be printed to add to files". In addition, as an HQ1 person pointed out, once emails are stored "*this allows them to be accessible by search, and also allows for them to be stored in context*". However, this person stated that *"many ... officers do not take the time to transfer their emails into EDMS. Provision of a bulk transfer facility would see more emails being stored in EDMS, as staff could then transfer a complete email folder at regular intervals."* The failure of many officers to transfer emails into EDMS was seen by site representatives to be due to a lack of intuitiveness of EDMS and associated procedural guidance.

The transaction overheads associated with complying with legislative requirements that were embodied in EDMS represented a significant cultural shift for many personnel. It represented a shift from having limited awareness of their responsibilities to having a mandated requirement to actively manage information. Many of the officers had not accepted their responsibilities with respect to legislative compliance, as evidenced by minimal use and work-arounds. The new practice of actively managing documents and information had therefore not been appropriated.

There were some unanticipated consequences following the implementation of the EDMS. People reported loss of documents or work due to usability issues and associated problems with understanding the behaviour of the system. The introduction of EDMS changed users' behaviour toward registry staff at HQ1. In the past, registry personnel were subject to staff frustration and anger caused by being unable to find or access information, however, this was no longer occurring. At an organisational level, the problem of sharing documents with non-EDMS sites was solved using a work-around that involved the in-house development of an automated web publishing capability.

5.4.1.3 Status of EDMS in 2006 and 2008

In 2006 a query was made about the status of EDMS with a member of the project team. He indicated that HQ1 and HQ2 were *"still very dependent on EDMS [and that] both sites have exceeded the hardware capacity"*. No comment was made about HQ3. He explained that the

web-based automated publishing solution, developed in 2003 to solve the problem of sharing documents with non-EDMS sites, was now a corporately supported system and in widespread use. He also projected that EDMS would not be replaced *"for a good while yet"*.

The additional HQ that was awaiting EDMS received it in June 2007. When asked about its status in 2008, the information manager at this location stated that *"members have just accepted it because they knew it was the endgame since 2003"*. The system had become *"part of what they do every day"*, which the information manager put down to:

- getting buy-in from the top
- keeping people informed
- prepositioning the HQ by restructuring network drives;
- establishing an information manager *"prior to implementation"*;
- setting up business rules and SOPs, such as file naming conventions, as part of an overarching corporate information management policy;
- providing face to face training of staff on business procedures and conventions related to information management;
- providing *"refresher training 6 months after implementation"*, and
- mandating use.

The information manager also strongly emphasised the need to monitor the storage behaviour of personnel, provide education to those not complying to show them easier ways to do things on the system, and if necessary enforce use by restricting or blocking access to the network drive, the one alternative storage option available.

Despite the above efforts there were still people who *"were not able to accept change"* and who had concerns about the system taking too long. Furthermore, the information manager reported that *"some members use the G [network] drive but I have restricted them to one folder"*.

Information from other sources confirmed that in 2008 EDMS was in widespread use in the three HQs and had been rolled out to other HQs working in the same domain as these HQs. Availability of the system had also been enhanced through replacing the NT server infrastructure with Unix servers. However there were still reports of occasional system

crashes and performance issues. The sites had also subsequently migrated from Lotus mail to MS Outlook.

5.4.1.4 Influences and patterns of appropriation over time

A. Changes in influences over time

Information about length of use was provided by 23 interviewees. Length of use ranged from one month through to nine months. An analysis of these data showed that there were no discernible differences in users' evaluations of the EDMS for those with limited system exposure compared with those with more. Written responses from the questionnaires (n = 18) were similarly analysed to see if there were any changes in user evaluations associated with length of use. The only pattern found was for system usefulness where there was a slight trend toward more positive views with longer use.

Comparing the findings from the initial and follow-up evaluations provided an additional way of exploring changes in influences, with data collection separated by four months. The salience of particular issues in users' minds was assessed by comparing the proportion of comments (written in the questionnaires and shared in interviews) that related to themes in common across the two phases (see Table 5.2). Usefulness, change management and business impact were more prominent initially than at follow-up, with usability, and support and training having similar prominence. The valence of responses was also examined but there was little to differentiate the two phases.

Theme	**Initial phase (n=68)[14]**		**Follow-up phase (n=43)[15]**	
	N (%)	**Pattern**	**N (%)**	**Pattern**
Usability	32 (47)	×[16]	17 (40)	×
Usefulness	30 (44)	✓/×	5 (12)	~ (✓/×)
Change management	30 (44)	×	10 (23)	×
Business impact	20 (29)	✓	8 (19)	✓
Support and training	11 (16)	×	6 (14)	~ (×)

✓ = mainly positive; × = mainly negative; ✓/× = mixed; ~ = insufficient data

Table 5.2 Comparison of prominent themes across phases

[14] Twenty eight users of EDMS and associated support personnel were interviewed, and 55 questionnaires were returned by users. However, 15 people contributed to both interviews and questionnaires. Therefore the total number was (28+55)-15 = 68.

[15] Fourteen people were interviewed, but one of these people had not been exposed to the EDMS. Thirty two completed the questionnaire, and two people contributed to both. Therefore the total number was (13+32)-2 = 43.

[16] Five pattern descriptors: mostly negative; somewhat negative, mixed, somewhat positive, mostly positive.

B. Changes in patterns of appropriation over time

The length of use data were used to identify if there were any changes in appropriations over time. However, the number of comments related to appropriation, with associated length of use data, was insufficient to support a trend analysis.

Data collected from 2003 to 2008 indicates that even though the EDMS met with considerable user dissatisfaction it had eventually been deployed to additional HQs. Furthermore, the use of the system was reported to be widespread in the HQs, and they were dependent on the system. Nevertheless, there were still reports of people minimising their use of the system. In addition, the in-house developed automated web publishing capability, to support document exchange with non-EDMS site, had been retained and had transitioned to a corporately supported system.

5.4.2 Quantitative data analyses

Data were analysed using descriptive and inferential statistics. An analysis was undertaken to identify particular evaluative items from the questionnaires employed for the initial and follow-up phases that the majority of respondents judged as either positive or negative. In addition, inferential statistics determined correlations between influences and measures of appropriation, as well as differences in influences between the initial and follow-up phases. Cronbach's alphas for all the multi-item measures were calculated and ranged from: 0.70 to 0.96 for the initial phase (see Table 5.3); and 0.85 to 0.97 for the follow-up phase (see Table 5.5). The findings for the initial phase are presented separately from the follow-up phase. This is because the follow-up questionnaire differed from the initial one by employing multiple measures of system use.

5.4.2.1 Influences on appropriation

A. Initial phase

Influences on appropriation were identified by calculating correlation matrices using pair-wise deletion of missing data. The complete matrices are contained in Appendix C.6. For the initial phase, frequency of use was significantly correlated with business impact, support and training, usability, ease of use, system design, usefulness, and expectations (organisational) (see Table 5.3). Usability included an item on system response times. Responsiveness or system performance was also assessed by timing how long it took for EDMS to complete a

range of tasks specified in the user requirement document, such as logging into the application or saving a new MS Word document into EDMS. This assessment found that the system was not meeting the required performance criteria at any of the three sites.

Variables	(Alpha coeff)	Frequency of use
Contextual influences		
Location	-	-0.15
Rank	-	0.04
General Attitudes	(0.76)	0.01
Competence	(0.86)	0.44**
Influences		
Business Impact	(0.95)	0.34*
Support and Training	(0.70)	0.31*
Procedures/guidelines	(0.87)	0.21
Usability	(0.91)	0.29* (0.27)
Ease of use	(0.82)	0.29* (0.25)
System Design	(0.93)	0.35** (0.32*)
Demands on users	(0.86)	-0.12
Usefulness	(0.96)	0.37**
Expectations (Org)	(0.95)	0.34*

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
_. Change in significance when controlling for location.

Table 5.3 Intercorrelations with frequency of use – initial phase [17]

Measures were included in the questionnaire to elicit data about the wider context (see Table 5.3 'Contextual influences'). Only competence in using EDMS was significantly correlated with frequency of use.

Because of the deployment of EDMS at different time points across the three HQs, and differences in implementation practices, there was a possibility that the above findings might be confounded by the location of participants. To address this, a partial correlation analysis was undertaken, controlling for location (see Appendix C.6). Largely the same pattern of significant correlations was found, with the exception of usability and ease of use, which were no longer significant (see Table 5.3).

An additional questionnaire given only to HQ3 personnel was analysed to identify which items were judged as either positive or negative by the majority of respondents. Respondents indicated that EDMS assisted in document tracking and that the search tool made it easier to

[17] The correlation between frequency of use and length of use is discussed in the next section and has therefore been excluded from this table.

find documents. The training and support provided by EDMS staff was also judged as adequate. EDMS was perceived by a majority of respondents not to have improved information management in the HQ, business practices, or collaborative creation of documents (see Appendix C.1 for the complete results).

The descriptive statistics are summarised in Table 5.4. The majority of respondents had positive views about business impacts, support and training, procedures and guidelines, and expectations about the future impact of the EDMS on the organisation. Perceptions were more equivocal for usability, effort demands, and error demands. The majority held negative views about system usefulness and system design, with close to half dissatisfied with ease of use.

Variables	N	Min	Max	Mean	SD	%>3[18]	%<3
Contextual influences							
General Attitudes	55	2.60	5.00	3.88	0.65	87	9
Competence	55	1.00	5.00	3.11	0.77	51	38
Influences							
Business Impact	55	1.17	4.72	3.26	0.82	65	35
Support and Training	55	2.60	4.60	3.67	0.51	80	11
Procedures/guidelines	53	1.00	4.40	3.29	0.75	68	26
Usability	55	1.46	4.46	2.89	0.72	45	49
Ease of use	55	1.00	5.00	2.60	1.05	27	49
System Design	55	1.00	4.33	2.63	1.08	35	55
Demands on users	54	1.67	4.71	3.04	0.78	42	51
Usefulness	55	1.00	5.00	2.60	1.19	40	56
Expectations (Org)	55	1.00	5.00	3.13	1.03	60	40
Appropriation							
Length of use (Months)	46	1	13	6.13	3.46	-	-
Frequency	54	3.00	6.00	5.52	0.95	-	-

Table 5.4 Descriptive statistics: influences on appropriation – initial phase

Two perceptual measures examined the personal context: attitudes toward computers in general, and competence. The large majority of respondents had positive attitudes toward computers in general, and a majority also self-assessed as competent users of EDMS.

B. Follow-up phase

[18] Percentage (%) of respondents whose average on the items for the particular scale was greater than (>) 3.

A correlation analysis, drawing on data from the follow-up questionnaire, identified a number of influences on appropriation. Appropriation patterns were assessed using more fine grained measures of system use:

- the number of document types stored or managed using EDMS (no of doc types);
- the frequency of using EDMS for each document type aggregated together (freq of use – agg doc types)[19];
- the number of activities performed using EDMS (no of activities); and
- the frequency of using EDMS for each activity aggregated together (freq of use – agg activities).

The following influences were significantly correlated with two or more of the system use variables: business impact, support and training, and usefulness. In addition, ease of use and system design were significantly correlated with number of document types. Controlling for location, via undertaking a partial correlation analysis, yielded five additional significant correlations between the system use variables and the explanatory variables (refer underlined correlations in Table 5.5).

Variables	(Alpha coeff)	Freq of use – agg doc types	No of doc types	Freq of use – agg activities	No of activities
Contextual influences					
Location		-0.26	-0.25	-0.30	-0.26
Rank		0.09	0.12	-0.01	-0.15
General attitudes		0.11	0.04	-0.25	-0.09
Competence	(0.91)	0.74**	0.73**	0.56**	0.45**
Influences					
Business Impact	(0.93)	0.43*	0.59**	0.43*	0.39*
Support and Training	(0.85)	0.36*	0.56**	0.35 (0.43*)	0.33 (0.40*)
Usability	(0.88)	0.08	0.24 (0.36*)	0.09	0.11
Ease of use	(0.88)	0.23	0.48**	0.25	0.20
System Design	(0.86)	0.35 (0.39*)	0.53**	0.32 (0.36*)	0.32
Usefulness	(0.97)	0.46**(0.44*)	0.62**	0.42*	0.40*

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
_. Change in significance when controlling for location.

Table 5.5 Intercorrelations with system use – follow-up phase

[19] the sum of rating responses (5 point rating scale) for each document type in terms of frequency of use.

Measures were again included in the follow-up questionnaire to elicit data about the wider context. Competence in using EDMS was significantly correlated with two of the system use variables.

The descriptive statistics are summarised in Table 5.6. A large majority of respondents had positive views about business impacts, and support and training. In addition, a majority were positive about usability, ease of use, system design and usefulness.

	N	Min	Max	Mean	SD	%>3	%<3
Contextual influences							
Rank	26	1.00	5.00	2.19	1.23	-	-
General attitudes	32	3.00	5.00	4.28	0.63	91	0
Competence	32	1.25	5.00	3.32	0.89	63	25
Influences							
Business Impact	31	2.38	5.00	3.83	0.68	90	7
Support and Training	31	1.33	5.00	3.73	0.84	77	16
Usability	31	2.06	4.75	3.43	0.73	65	29
Ease of use	31	1.00	5.00	3.21	0.99	58	32
System Design	31	1.67	4.67	3.44	0.80	68	19
Usefulness	32	1.00	5.00	3.23	1.12	59	28
Appropriation							
Length of use (Months)	28	1.00	16.00	6.18	5.26	-	-
Freq of use – agg. doc types	32	5.00	20.00	11.59	4.19	-	-
No of doc. types	32	1.00	4.00	3.13	1.01	-	-
Freq of use – agg. Activities	32	6.00	24.00	14.23	4.96	-	-
No of activities	32	1.00	5.00	3.66	1.10	-	-

Table 5.6 Descriptive statistics: influences on appropriation – follow-up phase

General attitudes toward computers and competence were used to examine the influence of the personal context. The large majority of respondents were positive about computers in general, and a majority also viewed themselves as competent users of EDMS.

5.4.2.2 Patterns of appropriation

A. Initial phase

In the initial phase questionnaire, appropriation patterns were examined using frequency of use and length of use. Frequency of use was assessed on a six point scale ranging from less than once a month through to several times a day. Forty-one of 54 respondents indicated they used it several times a day, four people indicated about once a day, five people selected a few times a week, and four chose a few times a month. The length of use of EDMS ranged from 1

to 13 months, with an average of 6.13 months. Included in the HQ3 questionnaire were three items assessing whether or not EDMS was used to support different activities. EDMS was being used by 19 respondents (n = 33) to create documents, 12 to store e-mails and attachments, and 11 to collaboratively create documents.

B. Follow-up phase

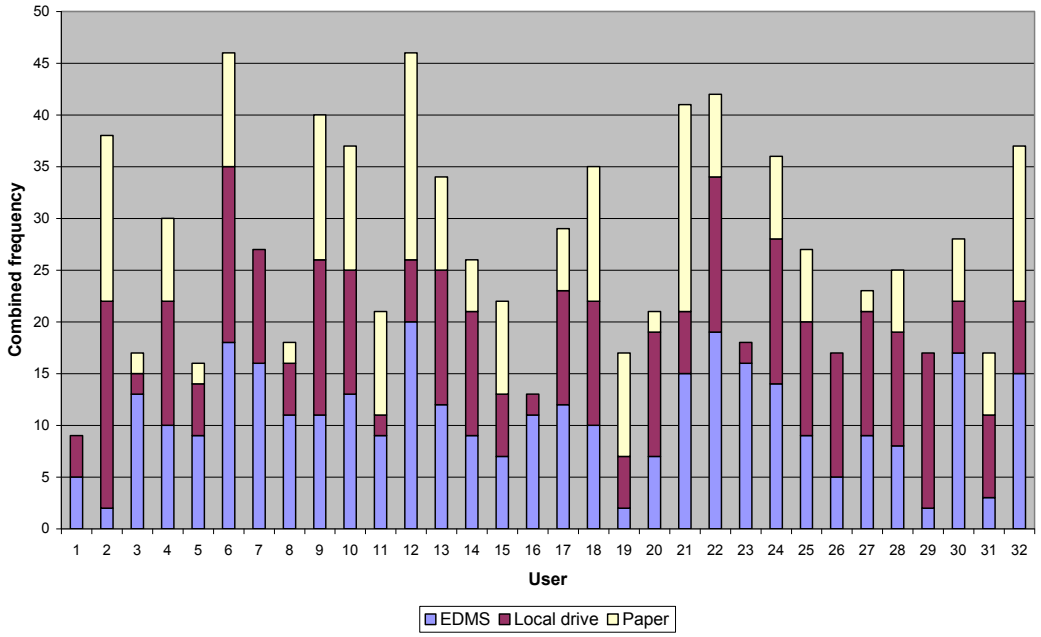
Appropriation patterns were again assessed using length of use. This showed that users had been using EDMS for between one and 16 months (mean = 6.2 months). More fine-grained measures of system use were employed to obtain a more detailed view of users' patterns of appropriation of EDMS. The number of document types stored or managed using EDMS ranged from one to four (mean = 3.1). The frequency with which EDMS was used to store particular documents showed that all users employed the system to store MS Word documents (32/32[20]), 81% used it for Excel (26/32), 71% for PowerPoint (22/31) and 61% for e-mail (19/31). In addition, MS Word was used several times a day by 50% of respondents (16/32), 19% used Excel several times a day (6/32), 10% for PowerPoint (3/31), and 16% for e-mail (5/31) The number of document and information management related activities supported by EDMS ranged from one to five (mean = 3.7). The frequency of use for each activity was as follows:

	% Used (n)	% used several times per day (n)
• Collaborative document development	63 (20/32)	9 (3/32)
• Search for documents	100 (32/32)	47 (15/32)
• create documents	97 (30/31)	42 (13/31)
• Use of correspondence reference numbers to share documents	84 (26/31)	29 (9/31)
• Access the emails of other personnel	26 (8/31)	0 (0/31)

Additional measures were also included to assess the frequency of storage and management of documents using electronic and paper based methods that pre-dated EDMS. These additional measures helped to situate use of the EDMS within a wider document and information management context. All participants were found to employ at least two different methods of

[20] Percentages derived from people who stored a particular document type "once a week or less" through to several times per day divided by the total number of responses.

storage, with 27 of 32 employing all three (EDMS, local drive, paper)(see Figure 5.2). Figure 5.2 also shows the extent to which methods for storing and managing documents varied across individuals. For example, user 1 employed EDMS and his network drives[21] to infrequently store MS Word and PowerPoint documents (refer Appendix C.7 for the individual level data), where as user 12 used EDMS and paper to store all four document types several times a day, but employed his network drives far less frequently.

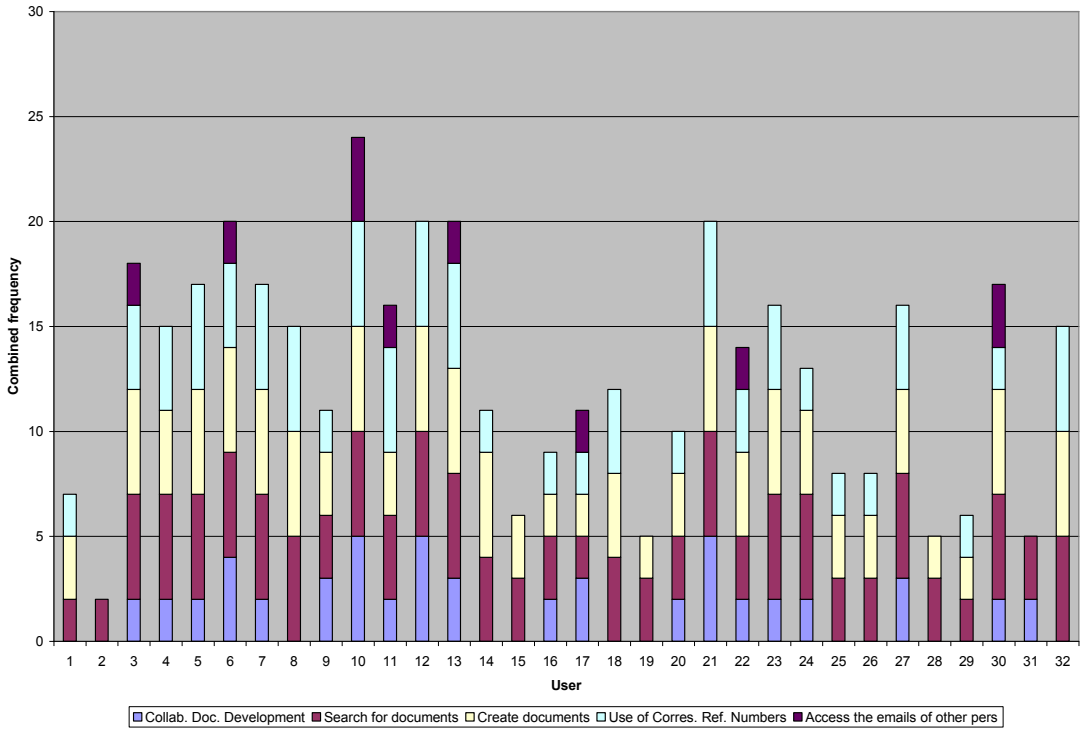


Numerical codes for frequency responses were: Never used = 0; Once a week or less = 2; A few times a week =3; About once a day = 4; Several Times per day = 5

Figure 5.2 Storage/management of documents by method – follow-up phase

The appropriation patterns of users were also measured by determining which of a range of document and information management activities were conducted using EDMS. In Figure 5.3 it can be seen that there was wide variability in terms of the frequency with which such activities were undertaken using EDMS. Use of the system ranged from user 2 who only employed EDMS once a week or less to search for documents, through to user 10 who undertook all of the activities, except for accessing the emails of others, several times a day (see Appendix C.8 for all user responses). Nevertheless, EDMS was used to search for and create documents by the majority of respondents, with more than half using EDMS for these activities about once a day or more.

[21] H drive / G drive / mail box



Numerical codes for frequency responses: as above

Figure 5.3 Use of EDMS by users to perform a range of activities– follow-up phase

5.4.2.3 Influences and patterns of appropriation over time

A. Changes in influences over time

The measure of length of use, based on when respondents first started using EDMS, supported a cross-sectional analysis of changes in influences over time. For the initial phase, a correlation analysis identified significant correlations with business impact, system design, effort demands, usefulness, and expectations (organisational) (see Table 5.7). The follow-up phase analysis revealed only one significant correlation, between length of use and competence. Controlling for location did not lead to any changes in the patterns of significant correlations.

Variables	Length of use	
	Initial phase	**Follow-up phase**
Contextual influences		
Location	-0.21	-0.23
Rank	-0.16	0.00
General Attitudes	0.19	-0.12
Competence	0.27	0.42*
Influences		
Business Impact	0.50**	0.18
Support and Training	0.12	0.09
Procedures/guidelines	0.24	-
Usability	0.21	-0.13
Ease of use	0.22	0.13
System Design	0.41** (0.35*)	0.06
Demands on users	-0.20	-
Usefulness	0.45**	0.18
Expectations (Org)	0.43**	-

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
_. Change in significance when controlling for location.

Table 5.7 Intercorrelations with length of use

B. Changes in patterns of appropriation over time

Correlation analyses provided a means of exploring changes in appropriation patterns over time. In the initial phase, length of use was significantly correlated with frequency of use ($r=0.29$, $p<0.05$). At the follow-up phase, length of use was significantly correlated with all four system use variables (see Table 5.8). Controlling for location did not lead to any changes in the patterns of significant correlations.

Variables	Length of use
Freq of use – agg. doc types	0.54**
No of doc. Types	0.42*
Freq of use – agg. Activities	0.66**
No of activities	0.44*

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
_. Change in significance when controlling for location.

Table 5.8 Intercorrelations between length of use and system use – follow-up phase

C. Comparison of initial and follow-up phases

Data collection for initial and follow-up was separated by four months. This enabled examination of changes in user appropriations and influences over time. Dependent variables in common across the two phases included: general attitudes, business impact, support and training, usability, ease of use, system design, usefulness, and competence. A multivariate analysis of variance (MANOVA) was undertaken with 'phase' as the independent variable.

When comparing the means for the dependent variables across the two phases the following variables were significantly different: general attitudes toward computers, business impact, usability, ease of use, system design, and usefulness (see Table 5.9). In addition, users' ratings were more positive at follow-up.

Dependent variable	Mean		F	Sig.
	Initial *(n=45)*[22]	Follow-up *(n=22)*		
General Attitudes	3.90	4.45	12.29	.00**
Business Impact	3.18	3.83	11.15	.00**
Support and Training	3.61	3.67	0.12	.73
Usability	2.78	3.46	12.41	.00**
Ease of use	2.48	3.14	5.74	.02*
System Design	2.46	3.37	13.42	.00*
Usefulness	2.52	3.14	4.34	.04*
Competence	3.01	3.28	1.72	.20

**. F is significant at the 0.01 level.
*. F is significant at the 0.05 level.

Table 5.9 Tests of between-subjects effects for the dependent variables across phases

Nine people completed both the initial and follow-up questionnaires. The data from these nine respondents was analysed separately. A t-Test comparing their responses identified no significant differences (t=-1.17, p=0.14).

Differences in appropriation choices across the two phases were investigated using a recoded frequency of use variable that allowed comparison between the phases. Respondents to the initial phase questionnaire used EDMS on average more than once a day (m=4.44, n=45) and follow-up respondents used it about once a day (m=4.14, n=22). This recoded variable was included in the above MANOVA. The difference between the means was not significant (F=1.43, p=0.24).

5.5 Contextualising the MTA for the EDMS case

In this section, the qualitative and quantitative analyses are combined and summarised so as to facilitate contextualisation of the MTA for the EDMS case.

[22] This cross-phase analysis was undertaken after first excluding the data from the nine respondents who completed both the initial and follow-up questionnaires. This reduced the number of respondents used to conduct the analysis.

5.5.1 Influences on appropriation over time: adoption and adaptation

Findings from the EDMS case enabled examination of the adoption decision and adaptation phase of the appropriation process. Investigating changes over time was supported by the cross-sectional and longitudinal data. The qualitative analysis of data from the initial phase showed that users' perceptions of the business impacts of EDMS were quite positive, however, users had more mixed views about the usefulness of the system. They were generally not satisfied with system usability, the support and training provided, and the management of changes associated with the introduction of EDMS. There were limited data from follow-up to support identification of changes, nevertheless, the findings suggest little if any change in users' overall sentiments.

Findings from the quantitative analysis for the initial phase also showed that users were positive about the business impacts and were somewhat mixed in their views about usefulness (see Table 5.10). There was also some consistency with respect to usability, with the system's design viewed negatively by a majority, and nearly half of users dissatisfied with the ease of use, and other aspects of usability such as the look and feel. However, the support and training provided was valued by a large majority of respondents, in contrast to the somewhat negative views of 11 people who provided comments on this issue. This was perhaps due to a negative reporting bias when writing comments in questionnaires. The questionnaires also assessed additional influences. Attitudes toward computers in general, procedures and guidelines, and future expectations about the impact of EDMS on the organisation were assessed positively by a majority. However, perceptions were mixed for self-assessments of competence and the demands placed on users by the system.

Influences	Inferential statistics		Descriptive statistics (%)	
	Initial	Follow-up	Initial	Follow-up
General attitudes	~	~	✓ (87,9)	✓ (91,0)
Competence	Use (**)	Use (**(4)) Length of use (*)	✓/× (51,38)	✓ (63,25)
Business impact	Use (*); Length of use (**)	Use (*/**(4))	✓ (65,35)	✓ (90,7)
Support and training	Use (*)	Use (*/**(4))	✓ (80,11)	✓ (77,16)
Procedures/guidelines	~	n/a	✓ (68,26)	n/a
Usability				
-Look and feel (GUI), performance, navigation	~	Use (*(1))	✓/× (45,49)	✓ (65,29)
-Ease of use	~	Use (**(1))	× (27,49)	✓ (58,32)
-Design	Use (*) Length of use (**)	Use (*/**(3))	× (35,55)	✓ (68,19)
Demands on users	~	n/a	✓/× (51,42)	n/a
Usefulness	Use (**) Length of use (**)	Use (*/**(4))	✓/× (40,56)	✓ (59,28)
Future impact of system	Use (*) Length of use (**)	n/a	✓ (60,40)	n/a

✓ = mainly positive (%>3); × = mainly negative (%<3); ✓/× = mixed; ~ = not significant or insufficient data; n/a = not assessed
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).
(N). = number of significant correlations with system use measures. Maximum = 4.

Table 5.10 Influences on appropriation over time (quantitative): initial and follow-up

The findings for the follow-up phase show that the majority of respondents had positive views on all of the influences assessed (see Table 5.10). Nevertheless, 32% of users were still dissatisfied with the ease of use.

Correlation analyses were undertaken to identify statistically significant influences on various measures of appropriation for the initial and follow-up phases (see Table 5.10). The analysis suggests that users from the initial phase with positive perceptions of business impacts, support and training, system design, usefulness, future impacts and competence also tended to use EDMS more. For the follow-up phase, users with positive views of business impacts, support and training, usefulness and competence were inclined to employ EDMS to store a wider range of document types and employ it to support a larger number of activities, and to do so more frequently. Users satisfied with the usability of the system - including look and feel, its ease of use and design - were more likely to store a greater number of different document types on EDMS. Those users positive about the design, also stored documents and undertook activities using EDMS with greater frequency.

Statistically significant changes in influences over time were determined using the length of use measure and through comparing findings between the initial and follow-up phases. At the

initial phase, users who employed EDMS for longer tended to be more satisfied with its business impacts, design, usefulness, and future impact on the organisation (see Table 5.10). For the follow-up phase the only significant relationship was between competence and length of use, indicating that respondents with greater exposure to EDMS also self-assessed as more competence users. There were eight influences in common between the initial and follow-up questionnaires: general attitudes, competence, business impact, support and training, usability (composed of look and feel, ease of use, and design), and usefulness. Comparison of these common influences indicated that all influences, except for support and training and competence, were significantly more positive at follow-up.

5.5.2 Patterns of appropriation over time: adoption and adaptation

The length of use measure was again used to identify changes over time. Users who were exposed to EDMS for longer also used it more frequently (see Table 5.11). They also used the system to store a greater number of documents types, and used it to support more document and information management related activities. At an organisational level, whilst the deployment of EDMS was initially limited to three HQs, it was eventually deployed more widely. Adaptation was also observed with the in-house development of an automated web-based document publishing capability. This adaptation overcame problems sharing documents with parts of the organisation not participating in the EDMS pilot. Three years after its development this local adaptation had transitioned to a corporately supported system and was in widespread use.

Certain document types and activities were widely employed by respondents. EDMS was used by all follow-up questionnaire respondents to store MS Word, and by a majority to store Excel, PowerPoint and E-mails. All respondents also indicated they used EDMS to search for documents, and all but one used it to create documents. It was also used by a majority to support collaborative document development, and share documents using correspondence reference numbers. Only 26% had used EDMS to access the emails of other personnel.

Appropriation measures	Initial phase (n=55)	Follow-up phase (n=32)
Unstable patterns over time		
Frequency of use (general and specific)	Higher frequency with greater length of use	Higher number and extent of activities supported with greater length of use Higher number and extent of docs stored with greater length of use
Wider deployment		EDMS deployed in additional HQ
Technology adaptation	Development of automated publishing capability	Transitioned to corporately supported system
Quantitative		
Length of use	1 to 13 months (mean = 6.13)	1 to 16 months (mean = 6.18)
Frequency of use		
- general (on average)	More than once per day	About once per day (derived)[23]
- specific: activities (% using EDMS for activity)	HQ3 only (n=33) (yes/no): Create documents (58%); Collaborative doc creation (33%)	Create documents (97%) Collaborative doc development (63%) Access e-mails of others (26%) Search for documents (100%) Use of correspondence reference numbers (84%)
- specific: doc types (% using EDMS for document storage)	HQ3: E-mails/attachments (36%);	MS Word (100%) E-mails (61%) Excel (81%) PowerPoint (71%)
Number of activities	n/a	1 to 5 (mean = 3.66)
Number of document types	n/a	1 to 4 (mean = 3.13)
Variation in number and extent of activities	n/a	Heterogeneous patterns across individuals (less so for search and document creation)
Variation in number and extent of documents stored	n/a	Heterogeneous patterns across individuals (less so for MS Word)
Qualitative		
Non-adoption	Not used by executive staff	n/r
Minimal use /workarounds	Yes (indirect – many)	Yes (4)
Core features not used	E-mail transfer function (indirect)	E-mail transfer function (indirect)
Technology adaptation	Integration of Lotus mail with EDMS	
User acceptance	n/r	Three HQs (2004): Yes (non-user perspective); Additional HQ (2008): Yes (Information manager perspective)
Dependence	n/r	HQ1 and 2 (2006): yes; Three HQs + additional (2008): Yes (widespread use)

n/a = not assessed; n/r = not reported

Table 5.11 Patterns of appropriation over time: initial and follow-up phases

Examination of individual patterns of use in terms of the number and extent of documents stored, and activities supported showed that there were heterogeneous patterns across

[23] The data collected for frequency of use of EDMS to support a range of activities was used to derive a single value.

individuals. There was, however, some homogeneity at a course-grained level with respect to storage of MS Word documents, with half of respondents doing so several times per day. Also, just under half of respondents employed EDMS several times a day to support document creation (42%) and document searching (47%).

Different types of appropriations were commented on and observed. EDMS was not used by the executive staff of one HQ. However, most users had little discretion over use since it was mandated. Nevertheless, minimal use of the system was reported, with users endeavouring to work around the system. Furthermore, core features of the system were not used by many users, particularly the e-mail transfer function. EDMS was modified to suit the application environment with the HQ. An add-on was created by the vendor for Lotus mail to enable transfer of e-mails, as it was not compatible with the existing product. User acceptance and organisational dependence on EDMS was reported in the follow-up phase, and the system was deployed more widely. Even so, there was still evidence of some users seeking to work-around the system.

5.5.3 The MTA contextualised for the EDMS case

The MTA was contextualised to reflect the findings from the EDMS case (see Figure 5.4), a case which covers the adoption decision and the adaptation phase of the appropriation process. The contextualisation process involved overlaying context specific influences and patterns onto the generic MTA, which are contained in the boxes surrounding the generic model. The contextualised model summarises the qualitative and quantitative analyses from the EDMS case under four key headings: influences on appropriation, patterns of appropriation, influences over time and patterns over time.

A summary of influences on participants' patterns of appropriation are presented in the top left box of Figure 5.4, with patterns of appropriation presented in the top right box. The ticks '✓' indicate that responses were mainly positive, with the crosses '✗' indicating mainly negative. The numbers in brackets denote particular measures of appropriation with which particular influence measures were significantly correlated. For example, the general frequency of use measure '(1)' was significantly correlated with perceived usefulness (see top left box). Usefulness was also significantly correlated with all four of the specific system use measures '(2,3,4,5)'. Changes in influences over time, and appropriation patterns over time,

were also examined and are summarised in the bottom left and bottom right boxes respectively. For example, perceptions of usefulness were more positive over time (↑)(bottom left box), and the frequency of using EDMS increased over time (bottom right box).

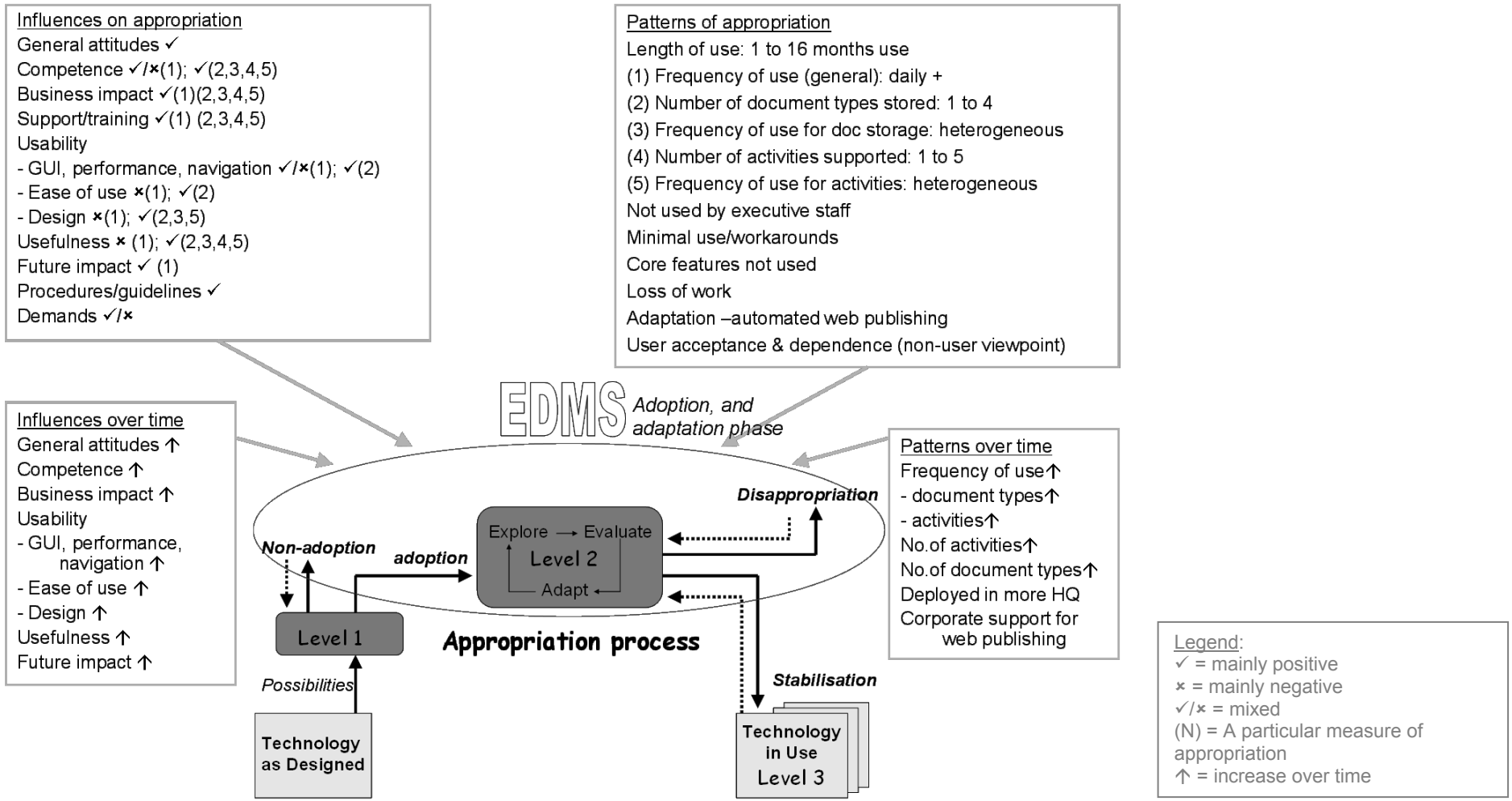


Figure 5.4 The MTA contextualised for the EDMS case

5.6 Generative mechanisms

Four generative mechanisms are employed in this research – lifecycle, teleology, dialectics and evolution - each of which provides an alternative explanation of the process of appropriation. The case findings will now be examined through the lens of each of these four mechanisms.

5.6.1 Lifecycle

The EDMS case involves a system that had been implemented across three HQ with users exposed to the system for different periods of time ranging from one to 16 months. Most participants were engaged in continued use of the system. Adoption of the system had largely occurred because use had been mandated so users did not have much discretion over using at least some aspects of the system. For example, the system was used by all of the respondents to store and manage MS Word documents. However, non-adoption had occurred, with the executive staff in one HQ not using EDMS.

According to the MTA, adoption is followed by a period of exploration, evaluation and adaptation. It is during this phase that users adapt their practices to incorporate the technology, or adapt the technology to meet their needs. All respondents to the follow-up questionnaire adapted their practices. For example, they all indicated use of EDMS to store or create MS Word documents. The use of EDMS for these purposes necessitated engaging in new practices, such as the incorporation of meta-data upon creation of a new document. These new practices did not necessarily entail the replacement of pre-existing practices, with 27 of 32 respondents employing all available storage options to support their document storage needs. Adaptations to EDMS also occurred. At an organisational level, an in-house developed automated web publishing capability was introduced to overcome problems sharing documents with parts of the organisation not participating in the EDMS pilot. The EDMS vendor also created an add-in for Lotus mail, as part of this deployment, to enable transfer of e-mails into EDMS. Individual level adaptations were evidenced by variations across individuals and over time in the number and extent of document types stored, as well as activities support. Partial appropriations of EDMS were evidenced by limited use of core features, as well as workarounds. More complete appropriations were manifested by individuals drawing on EDMS for a wider range of document types and activities.

Over time, the MTA posits that adaptations cease and use patterns stabilise. Furthermore, patterns of 'technology in use' are heterogeneous across individuals, represented by the stacked boxes to the right of the MTA (see Figure 5.4). Whilst the findings did not readily support identification of stabilisation at an individual level, there clearly was evidence of heterogeneous patterns for both document storage and activities. The MTA may need to be adjusted to convey the heterogeneity of use patterns during adaptation and stabilisation. At an organisational level, there was some evidence suggesting that patterns of appropriation had stabilised with the use of EDMS by users described as being *"part of what they do every day"*, and reports of user acceptance and organisational dependence on the system. The transitioning of the automated web-publishing system to become a corporately supported system was an additional organisational level adaptation. The act of making it a corporately supported system and its widespread use also suggest a move toward routinisation.

The way in which EDMS became situated with pre-existing document and information management technologies and practices was an important finding. EDMS was introduced into an organisation where individuals had developed a range of practices supported by paper, e-mail and various network storage options. Findings from previous evaluations conducted in one of the three HQs provided insights into the technologies and practices employed by users prior to the introduction of EDMS, as did the use of the repertory grid technique (see section 5.3.2). Consideration of prior appropriations is not included in the MTA, but is an important influence on how users come to evaluate new technologies. Prior appropriations could be viewed as a contextual influence to be incorporated with the MTA.

5.6.2 Teleology

In this case, the purposeful pursuit of goals by intentional agents operated at the organisational and individual level, which provided a multilevel examination of teleology. The implementation of EDMS was intentional. Once implemented, individuals also engaged in intentional acts.

At the organisational level, there was recognition of document and records management problems in the HQs. There was pressure on the HQs to improve their capacity to satisfy information requests from higher level HQs and from government. In addition, there were a number of internal concerns about extant document and information management practices.

Key stakeholders therefore decided that a document and records management solution should be acquired, piloted and implemented.

Once EDMS was implemented, participants made active appropriation choices shaped by a variety of influences. Consistent with prior research, perceived usefulness and ease of use were significantly correlated with system use (Davis et al. 1989; Karahanna et al. 1999). Other significant influences on use supported by prior research included support and training (Al-Gahtani & King 1999; Igbaria et al. 1995), and competence (Clegg et al. 1997; Compeau et al. 1999; Henry & Stone 1997). System design, and business impacts (the extent to which EDMS had led to improvements in specific document and information management tasks) were also related significantly with system use.

The ways in which participants utilised EDMS in part resulted from intentionality. For example, some users had experienced loss of documents they were working on and many users had been affected by the system being unavailable on occasion, preventing them from accessing certain documents. As a result, a number of users decided to minimise their use of the system, or actively workaround it, in order to reduce the chances of losing work or having problems accessing documents in the future.

5.6.3 Dialectics

In this case, tensions or contradictions are analysed at two levels: the EDMS artefact, as well as users' practices and associated technologies. EDMS provided users with functionality designed for a variety of document and information management tasks. User perceptions of the value of this functionality, assessed using the business impact measure, were generally quite positive. However, users were far less positive about system usability, with almost half of those providing comments raising concerns. From a dialectic perspective, system functionality represented the thesis and usability the antithesis. Outcomes from this tension included:

- users effectively appropriating system functionality to support their work (dominance of functionality)
- users minimising use of EDMS (dominance of usability concerns)
- users employing core functions that were easier to use, such as document search and creation, and avoiding those that were more complex, such as collaborative document

development. In the latter case, there were reports of personnel maintaining paper-based approaches.

Prior to the introduction of EDMS, users' document and information management practices were supported by a portfolio of technologies: paper, e-mail, and network drives. Carroll (Carroll 2005) uses the phrase "technology portfolios" to convey the use by people of a mix of complementary technologies that support their practices. This portfolio of document and information management technologies represented the thesis. The introduction of EDMS and associated information management procedures represented the antithesis. Maintenance of the status quo, the thesis, was difficult since use of EDMS was mandated. Nevertheless, there was evidence of non-adoption and partial appropriations. Examination of the different storage options used provided a means of identifying substitutions. Twenty seven of 32 respondents to the follow-up questionnaire used all available storage options suggesting that substitutions had not occurred for most users. Nevertheless, an examination of individual responses (see Appendix C.7) shows that four people had replaced storage of MS Word documents on network drives with storage on EDMS. Various syntheses were the most common outcome, with EDMS becoming part of users' portfolios of technologies and associated practices, rather than replacing the existing technologies within their portfolios.

5.6.4 Evolution

An important influence on the appropriation choices of some individuals was the experience of losing documents. This was an unanticipated variation. People working in the HQs were in time-poor and information-rich environments that constrained their capacity to incorporate new technologies and practices. Losing work introduced an additional time impost because those affected needed to rewrite documents. A consequence of such an event was a strong drive to revert to technologies and practices that pre-dated EDMS, and minimise use or work around EDMS.

Retention of existing technologies and practices was apparent not only for those who had lost work, but for all of those people who completed the follow-up questionnaire. All 32 respondents employed at least one other method of storage besides EDMS, with most employing paper, network drives (home drive, group drive and mail box) and EDMS (n=27).

5.7 Summary

Following the introduction of the EDMS, why did users' appropriations vary? Variability in users' appropriations was influenced by competence, business impacts, support and training, EDMS's usability, usefulness, and future impact (see Figure 5.4). Significant changes in influences over time were identified for business impact, usability, usefulness and future impact, with the trend more positive over time.

A wide range of appropriation patterns were identified including:

- non-adoption;
- adaptations - variation in the number and extent of document types stored and activities supported, the automated web-publishing solution, and changes to practices;
- partial appropriations – minimal use of core features and workarounds;
- more complete appropriations – use for wider range of document types and activities; and
- stabilisation - some evidence via acceptance, dependence and incorporation.

Over time, the number and extent of document types and supported activities increased. Furthermore, the HQs became dependent on the system. The EDMS was also eventually deployed to additional HQs.

Viewing the results through the lens of each of the four generative mechanisms assisted in drawing out additional insights:

- Lifecycle: Prior appropriations (related technologies and practices that existed prior to the introduction of a technology of interest) are an important influence on how users come to evaluation new technologies.
- Teleology: Consideration of intentionality at an organisational level provided understanding of the rationale for introducing the system. Individuals' appropriations were influenced by a variety of established and case specific measures. Furthermore, the goals of particular individuals were shaped by particular experiences, such as choosing to minimise use of the system due to experiencing loss of work.
- Dialectics: Users' positive perceptions of EDMS functionality were in tension with their concerns about system usability, which helped to explain diverse appropriations. The concept of technology portfolios similarly assisted with explaining the variety of appropriation outcomes, by highlighting the tensions between the collection of pre-existing technologies and the EDMS.

- Evolution: Unanticipated events had a bearing on users' appropriations, such as the loss of work and subsequent choices to minimise dependence on EDMS by retaining prior technologies and practices as much as possible. Understanding retention was enhanced by considering use of EDMS alongside of pre-existing technologies.

Chapter 6: The electronic mail case

6.1 Introduction

E-mail is a mature and pervasive technology that plays a central role in the conduct of business. It is thoroughly incorporated or embedded with users' practices, including communication, as well as individual and group level management of information, tasks, and time (Mackay 1988; O'Kane & Hargie 2007; Whittaker 2005). The particular e-mail application examined was part of Microsoft Office Outlook 2003. The system was in use in the Defence Science and Technology Organisation (DSTO), which is the part of Defence responsible for providing advice on science and technology related matters. The mature and embedded nature of e-mail made it well suited to investigating the stabilisation phase of the appropriation process where stabilisations in patterns of appropriation are posited to occur. However, according to the MTA, such stabilisations are subject to modification if users' evaluations of the technology change. This case therefore also explored the adaptation phase. The research questions addressed by this case are:

- Why did users' appropriations of e-mail vary?
    - What are the influences on appropriation of e-mail in the context of communications, information management and planning practices in DSTO?
    - What are the patterns of appropriation of e-mail in the context of communications, information management and planning practices in DSTO?

These questions represent contextualised variants of the research questions described in Chapter 3. These questions have been made specific to a particular technology (e-mail), particular practices (communications, information management and planning), and a particular context (DSTO).

In this chapter the e-mail case is outlined by describing the nature of the e-mail artefact, practices associated with its use and the organisational context. The research methodology is then elucidated. The qualitative and quantitative results are presented, which together with the case description are used to contextualise the MTA for the e-mail case. The findings are then examined through each of the four generative mechanisms.

6.2 Case description

6.2.1 The technology – MS Outlook e-mail

At the time of collecting data for this case, MS Office Outlook 2003 was the preferred e-mail client in DSTO. It was made available to personnel in 2005 as part of the roll-out of Office 2003. Much of the functionality provided in Outlook 2003 was facilitated and enabled by MS Exchange server. This combination of Exchange and Outlook was available to DSTO personnel for approximately 10 years (~ 1998). However, e-mail in its various forms was available for more than 20 years. The e-mail application is at the core of Outlook. Outlook also includes a calendar, contact manager, task manager, a notes application, and a journal (see Figure 6.1 for the default screen configuration). All of the participants in this case used Outlook 2003 e-mail.

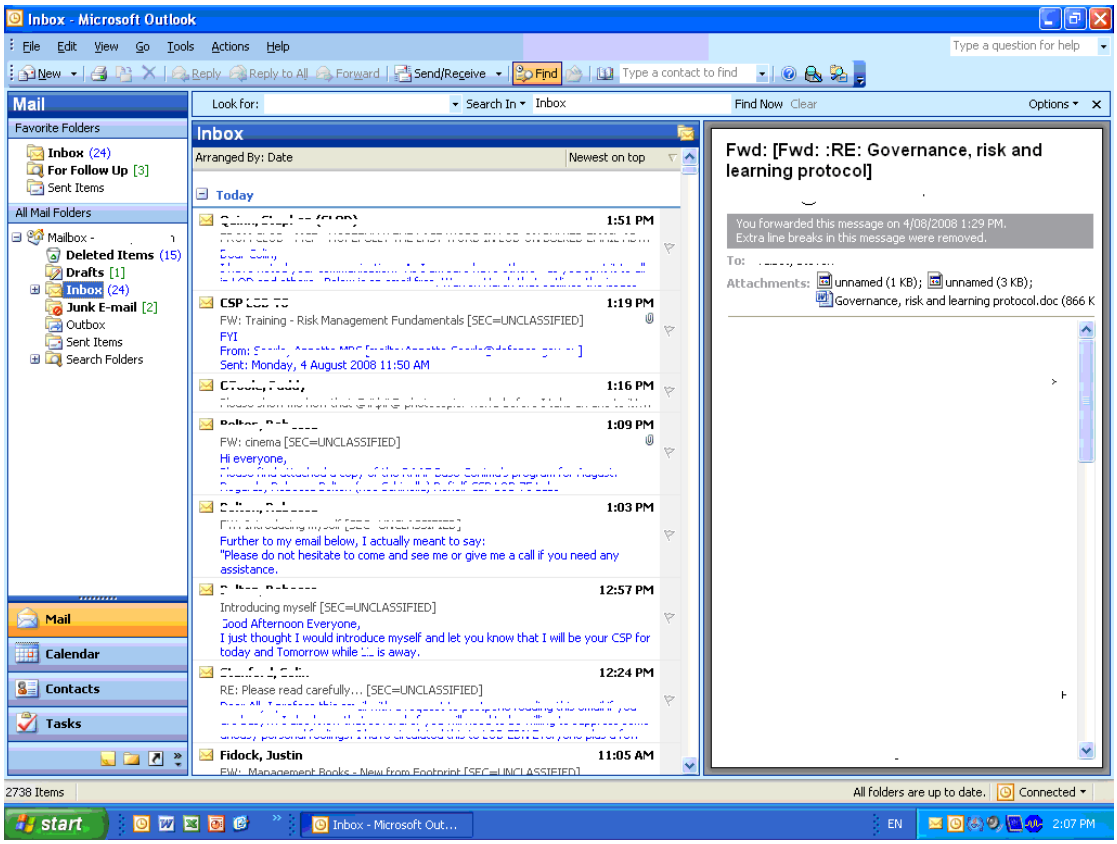


Figure 6.1 Default Microsoft Office Outlook 2003 configuration

Access to e-mail was largely provided via desktop computers connected to the DSTO network. Some employees used laptops that allowed them to use Outlook in offline mode. In addition, a number of employees could access their accounts via dial-up and broadband links (fixed and mobile). There was no capacity to access e-mails via internet based web-mail or

via a mobile e-mail service such as Blackberry, although a small trial on the latter was underway in 2009.

6.2.2 Practices associated with e-mail

Every employee in DSTO had an e-mail account. E-mail was central to the conduct of business practices within DSTO.

E-mail:

- was used to coordinate work activities;
- provided a means of sharing and managing information, including previous correspondence and work in progress;
- provided a means for management and various corporate functions to keep personnel up to date on plans, events, administrative requirements and policies;
- assisted with time management and organising meetings (in conjunction with the calendar function).

In addition, it supported various social practices, such as organising social events, and sending jokes. The use of e-mail for this variety of practices was pervasive in DSTO and for many personnel it required significant time and effort. The extent and nature of use of e-mail was not homogeneous, as will be discussed.

6.2.3 The organisational context

DSTO was composed of scientific, technical and support personnel with a third of the work force having PhDs and many others with graduate and postgraduate qualifications. The organisation had three intermingled cultures operating:

- the public service culture, focussed on providing advice to the Defence department to support decision making;
- the professional engineering culture, which drew on domain expertise to modify existing Defence technologies and create new technologies;
- the academic culture, focussed on delivering reports and papers and presenting at conferences.

Structurally the organisation most resembled a professional bureaucracy (Mintzberg 1979) with personnel given considerable autonomy in deciding how to undertake their work, particularly those personnel engaged in providing science and technology advice to Defence. The organisation had complex advisory, coordination and planning requirements that had led

to more than half of the organisation being executive level personnel or above. These requirements also had led to a very hierarchical structure with seven layers from the first executive level through to the Chief Defence Scientist. As a consequence, many processes and support structures were in place to administer the organisation.

The widespread availability and use of e-mail emerged around 1998 and was tied to the introduction of an effective networked operating system, as well as the introduction of MS Exchange server and Outlook.

An audit of DSTO internal communications in 1994 found that people at DSTO were not provided with any training on how to use e-mail (for example, mechanics, protocols and rules)(Copleston 1994). In addition, there was limited development and enforcement of guidance on appropriate use. E-mail specific policies emerged over time relating to the type of content that was considered appropriate, as well as reinforcing the need to not use e-mail for anything that was illegal or in breach of other relevant policies and principles. However, for many years little guidance on appropriate use was provided other than dealing with the distribution of classified material and the inappropriate use of large mailing lists to pursue personal agendas. This situation started to change in 2007 with the distribution of a booklet on "Using e-mail in Defence", and by the introduction of an archiving solution to facilitate storage and management of e-mails. The booklet provided basic guidance on: writing e-mails, including consideration of appropriateness of using e-mail, message construction and presentation; responsibilities with respect to managing e-mails as Defence records; the rules and policies on e-mail in Defence, including size limits, use of the Out of Office assistant and signature blocks. The archiving solution automatically backed up any messages in the inbox and sent items that were more than 12 months old. Enforcement of appropriate use was limited to:

- improper use of large mailing lists,
- preventing material from leaving the network that was not given a classification label, and
- notifying when the users mail folders were over the size limit, although no limits on sending/receiving mail were enforced.

No training was provided, however, to reinforce guidance, rules and policies.

6.3 Research methodology

6.3.1 Participant characteristics

The participants in the e-mail case were drawn from personnel who worked in one division of DSTO. Participants represented a cross-section of personnel based on:

- gender: 76% males (29/38) and 24% females (9/38)[24];
- age: ranging from 20s through to 56 and over [25];
- time in the organisation: less than 1 year to 10 years and over [26]; and
- position: from entry level defence scientist through to branch head, as well as from different parts of the division.

The number of years of using e-mail varied from four to 28, with participants averaging 15 years (SD = 6.13). In total there were 39 e-mail users (28% of the division). In addition, four people helped build the case description, for a total of 42 participants[27]. The study involved two phases, with 16 people contributing to both phases.

6.3.2 Research foci and methods employed

E-mail represents a technology that is mature and pervasive in DSTO. It is also a technology which most people in DSTO have employed for many years. These characteristics made it suitable for examining the stabilisation phase of the appropriation process, which is a phase of system use that is not often examined (Baker 2007; Jasperson et al. 2005). The stabilisation phase involves stabilisations in users' appropriation patterns, but adaptation of these patterns can again occur if users' evaluations of the technology change. Adaptations occurred in this case. The data from this case therefore supported assessment of both the stabilisation and adaptation phases of appropriation (see Figure 6.2).

[24] The organisation has 86% males and 14% females.
[25] 18 to 25yo (3%, 1/36), 26 to 35 (39%, 14), 36 to 45 (22%, 8), 46-55 (25%,9), and 56+ (11%, 4).
[26] 8% (3/37) less than 1 year, 41% (15), 1 to 5 years, 27% (10) 6 to 10 years, 24% (9) more than 10 years.
[27] One person contributed to the e-mail data collection and the development of the case description.

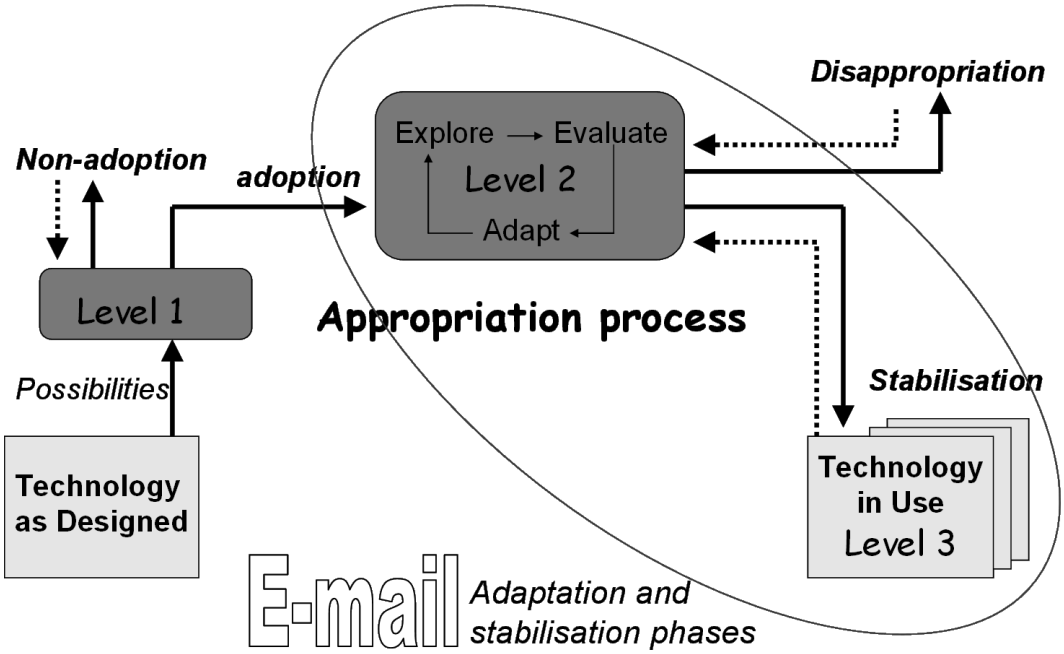


Figure 6.2 Mapping of E-mail case to the MTA

Multiple methods were employed. In addition, data collection occurred in two phases to investigate any changes in influences and patterns of appropriation over time. In the initial phase 23 people were interviewed and 31 completed questionnaires (see Appendices D1, D2 and D4). In the follow-up phase 16 of the 23 interviewees from the initial phase completed a questionnaire followed by an interview (see Appendices D3 and D5). The time between interviews ranged from 9 to 24 months with an average of 19 months (SD = 6.15). Additional information to develop a case description was derived from a journal kept by the researcher, policy statements (contained in documents and e-mails), reports on e-mail use, and discussions with four individuals with historical and corporate knowledge of e-mail use in DSTO. Research foci and issues assessed using particular methods are summarised in Table 6.1.

Research foci	Method	Issues assessed
Influences on appropriation	Questionnaires	Forced choice: demographics, e-mail experience, e-mail training
		Semi-structured: like best/least about e-mail (attitudes); first start using e-mail
		Rating scale measures: Attitude toward computers; Usability; Demands on users; Perceived usefulness; Competence
	Interviews	Contextual: Describe and demonstrate reason/s for screen configuration
		Repertory grid: E-mail compared/contrasted with other communication channels identified by interviewees
		Semi-structured: Expansion and clarification of questionnaire responses
Patterns of appropriation	Questionnaires	Rating scale measures: Nature of IS use; Habitual use; Voluntariness
	Interviews	Observations: number of e-mails in inbox/unopened; Number of e-mail folders; Screen shot of e-mail configuration
		Contextual: Describe and demonstrate checking of e-mails; management of e-mails and attachments
		Semi-structured: E-mails sent/received on average each day; Filing of e-mails (frequency); Times per day e-mail checked, and when; E-mail is like….(E-mail similes)
Case description	Documentary evidence	E-mail policies and guidance, reports
	field notes	Record of events and issues
	e-mail inquiries and discussions	Construction of a history of e-mail in DSTO: use by personnel and technological trajectory

Table 6.1 Research foci, methods, and issues assessed

6.4 Results

The data were used to investigate influences on users' evaluations of e-mail, their appropriations of the system and how the influences and appropriation choices varied over time. Data from the 16 participants who contributed to both phases was the primary source, augmented by additional data from the initial phase. General themes and issues were first identified. This was followed by an exploration of any changes in influences and appropriate patterns over time. Analyses based on the qualitative data are presented first.

6.4.1 Qualitative data analysis

Qualitative data were generated via written comments in the questionnaires, and from notes and observations from the interviews. Interview notes were augmented by audio recordings and screen shots. The data were analysed to identify influences on and patterns of appropriation.

6.4.1.1 Influences on appropriation

In all of the questionnaires, respondents were asked what they liked best about email and what they liked least. Findings from the analysis are summarised in Table 6.2 and Table 6.3.

E-mail likes	**Themes**	**Number of respondents (total n=39)**
Speed of delivery	Usability	17
Automatically creates a record	Functionality	16
Enables asynchronous information exchange	Functionality	12
Ease of use	Usability	8
Ability to attach files/documents	Functionality	7
Providing time for more considered responses	Usefulness	7
Calendar	Functionality	6
Ability to distribute to multiple addressees	Functionality	6
Support to information management (searchable, filing system)	Functionality	5
Efficiency of expression and time use	Usefulness	5
Being able to keep in contact with people	Usefulness	3
Reliability (of delivery)	Usability	3

Table 6.2 What do you like best about e-mail?

The speed and immediacy of communicating via e-mail was raised by 17 of the 39 questionnaire respondents as the thing they liked best about e-mail (see Table 6.2). This was closely followed by 16 respondents viewing e-mail as providing *"a record of communications"* and an *"audit trail of correspondence"*. Twelve people liked the asynchronous nature of e-mail, the capacity to *"deal with "things" regardless of whether others [are] available"* and not having to be *"face-to-face"*. Associated with this, seven people liked the time e-mail provided for more considered responses: *"Having time to respond to a request and being able to think thoughtfully about the response"*. People also appreciated the ease of use of e-mail (8), the ability to attached files and documents (7), integration with the calendar function and the support this provided to meeting and time management (6), and the *"ability to distribute to multiple addressees"* (6). Common themes associated with e-mail likes were functionality, usability and usefulness (see second column of Table 6.2).

E-mail dislikes	Themes	Number of respondents (total n=39)
Spam	Social norms	14
Ambiguity of communications (tone, inability to convey nuances)	Social mediation	11
Difficult to manage information	Usefulness	7
Slows down mutual understanding	Social mediation	7
The volume of email	Usefulness	4
Inappropriate usage	Social norms	4
Expectation from others of quick response	Social norms	4
Loss of face-to-face contact	Social mediation	4
People can ignore important messages	Social norms	3
Assumption message receive, understood	Social norms	3
Highly distractive	Usefulness	3
Very time consuming	Usefulness	3
People use it informally for official purposes	Social norms	3

Table 6.3 What do you like least about e-mail?

Spam was identified as the least liked aspect of email by 14 respondents (see Table 6.3 above). They disliked receiving *"too many junk emails"* and *"receiving things that I'm not interested in"*. Eleven people indicated they disliked the ambiguity of communications associated with e-mail messages: "*sometimes what you say can be taken out of context as there is no voice expression"*. A range of information management challenges associated with e-mail use was raised by seven people: it can be *"difficult to discriminate between rubbish and important stuff"* there is *"no integration into an e-knowledge management system"* and *"no prioritisation of information"*. Seven people also disliked the impersonal and a-contextual nature of e-mail and the lack of interactivity, which can in turn lead to communication breakdown or lack of understanding. Related to this, four people did not appreciate the reduction in face-to-face communication. People also disliked: the volume of e-mails and associated information overload (4); inappropriate use, such as *"inappropriate cc-ing"* (4); expectations from others of a speedy response (4); and *"non-response from recipients"* (4). Common themes associated with e-mail dislikes included social norms[28], social mediation[29] and usefulness.

Eighteen of 23 interviewees completed the repertory grid. The dominant three communication channels compared and contrasted by people were e-mail, telephone and face-to-face. Interviewees' comparisons conveyed the affordances and constraints associated with e-mail,

[28] Social norms – rules developed by a group of people that represent beliefs and attitudes about how others should or should not behave. Social norms shape how individuals behave and how they judge the behaviour of others (adapted from www.sociologyguide.com; Venkatesh et al.(2003); Weber (2004)).

[29] Social mediation – the ways in which a communication channel constrains and enables interpersonal communication (influenced by Trevino et al. (1987)).

as well as the functionality, usefulness and usability of e-mail and its role as a social mediator. All interviewees provided at least one comparison where e-mail and telephone were viewed as similar to each other but different to a third channel, which was either face-to-face communication (15), or meetings (3). E-mail and phone were seen to afford people the capacity to communicate over large distances via the functionality offered by e-mail (4). These two channels were also seen to mediate social interactions by providing a "*degree of anonymity"*, and a way of avoiding face-to-face contact with people. E-mail and phone were also viewed as constraining certain aspects of communication. In particular, six of eight people saw face-to-face communication as providing visual cues and feedback compared with e-mail and phone. The remaining two people saw face-to-face as not being interrupted by a connection failing, and being easier since it *"does not depend on connectivity"* (usability).

Fifteen interviewees paired phone and face-to-face in comparison to e-mail. E-mail was viewed as affording time to consider, plan and prepare responses, as well prioritising responses (5 interviewees)(usefulness). It was also seen to support record keeping (2)(functionality). Unlike phone and face-to-face, however, e-mail provided no non-verbal cues, and intonation, as well as minimal or readily misunderstood tone (7) (social mediation). E-mail was also viewed as providing slower understanding (social mediation) and exchange of information (4) (functionality).

6.4.1.2 Patterns of appropriation

Patterns of appropriation were investigated through examining rhythms of use, differences in management of messages, screen configurations and similes generated by interviewees. The daily rhythms of use were assessed by asking people how often they checked their e-mails and when this checking occurred. Three distinct rhythms were identified: responding as messages were received, at set times and sporadically or periodically during the day. These rhythms were identified in pure form, but were more commonly found in combination. For example, nine interviewees checked for new e-mails at set times as well as when messages were received: *"I make a point of checking emails in the morning when I come in as a default and obviously at the end of the day, and anytime when I leave the computer and come back, and other than that I check them when they pop up"*. The rhythms of use are summarised in Table 6.4 below. Eighteen of 23 interviewees had rhythms of use that were either wholly (6) or in part driven by the receipt of messages. For this grouping the "new Mail Desktop Alert",

which appears at the bottom right of the screen and then gradually fades following the arrival of a new message in the inbox, was the most prominent stimulus to check new messages (17).

Rhythms	Number of interviewees
Message receipt (MR)	6
Set times (ST)	1
Sporadic/Periodic (SP)	1
Combination (ST/MR)	9
Combination (ST/SP)	3
Combination (SP/MR)	3
Some or all MR	18
Some or all ST	13
Some or all SP	7

Table 6.4 Daily rhythms of use

The nature of these rhythms with respect to voluntariness and habitual use was also investigated by asking interviewees to explain their responses to the questionnaire measures assessing these concepts. Thirteen people provided explanations for their ratings on the voluntariness measure. The comments showed that eight people were ambivalent in the sense that use was not mandated, but that organisational practices essentially made them captive users: "*it is voluntary to the extent that I am not forced...but the majority of staff use it…the nature of DSTO as an organisation tends to favour its use"*. Four of these provided a rating of 3 (neither agree nor disagree) with the remaining four providing ratings of 1 (strongly disagree), 2, 4 and 5 (strongly agree). Three individuals confirmed their ratings of 1 or 2, seeing their use of e-mail as not being discretionary: *"not an option to opt out"*. The remaining two individuals saw their use as discretionary. Twelve interviewees commented on their ratings on the habitual use measure, with nine people explaining why they saw their use as habitual: *"because I check it as soon as I log on, and will check it throughout the day*", *"having used email for at least 10 years it has become second nature"*, and *"it has become part of how I structure my day and do my job"*. The remaining three people were a little unsure if their use was habitual. One interviewee explained that his use was not habitual since it had not "become a compulsion". Another interviewee strongly disagreed that his use was habitual but then explained how his checking of messages first thing was habitual.

A contributor to the rhythms of use was the default alert settings associated with e-mail. By default, when new messages arrive in the inbox a sound is played, the mouse cursor briefly changes to an envelope, an envelope icon is displayed in the notification area and the new

mail desktop alert pops up on the screen. About half (12) of the 23 interviewees were using the default alert settings, seven were employing a subset, two had turned off all alerts and two had made modifications to the sound file played upon message receipt. The most common adjustment was to turn off the sound (10). The new mail desktop alert pop up was disabled by five people.

The ratio of messages in the inbox to the number of folders was used to identify qualitatively different patterns of e-mail use associated with how interviewees managed messages. Three broad patterns were identified:

- inbox centric: messages primarily retained in the inbox;
- folder centric: messages largely stored in categorised folders;
- combination: messages stored in both the inbox and folders. The last pattern was further sub-divided into low, medium and high.

Screen-shots from five interviewees representing each of these patterns are presented in Figure 6.3.

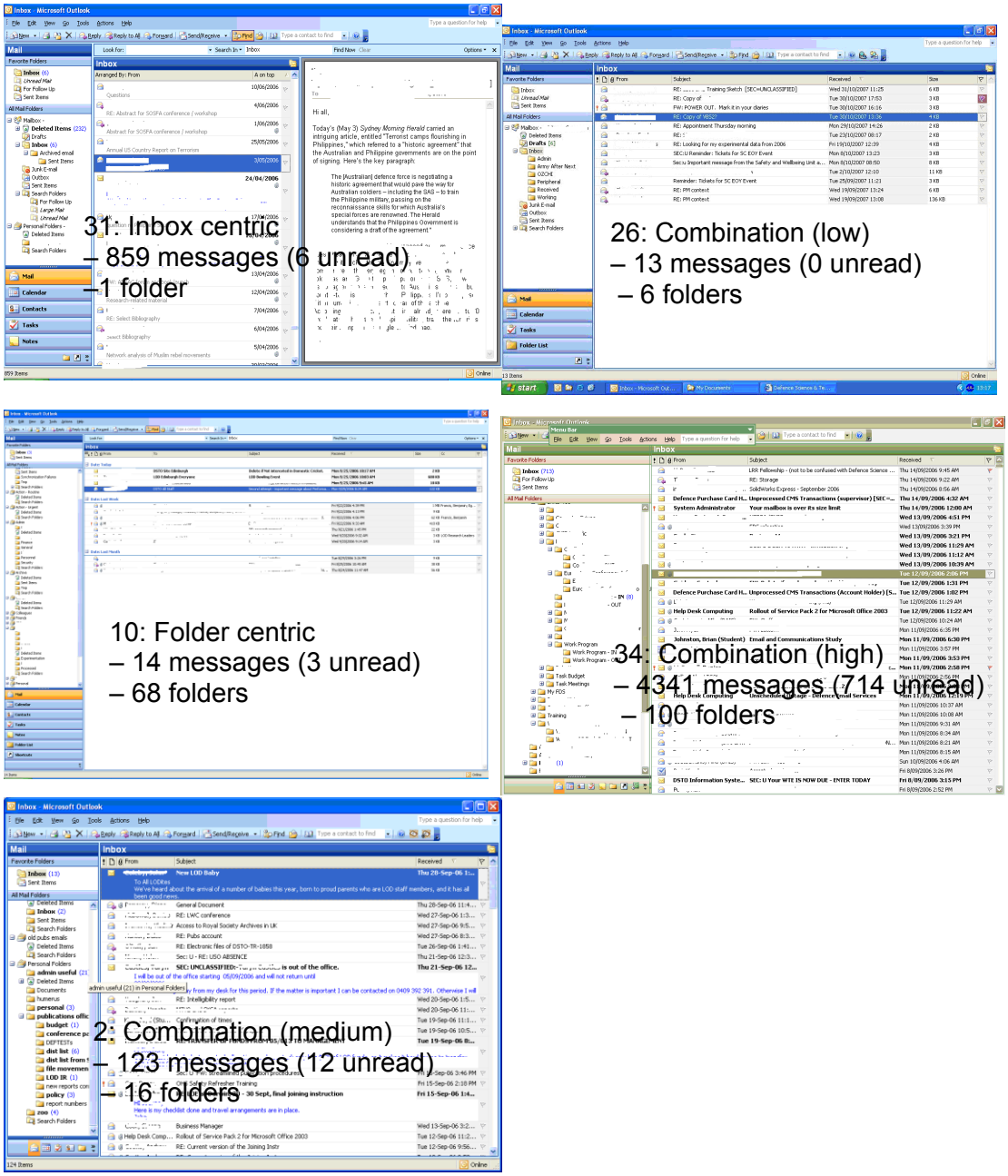


Figure 6.3. Patterns of e-mail management: screen shots

Of the 23 interviewees, 12 were classified as having a combination pattern, with seven having a high number of inbox messages and folders, three having a low number of each and two having a moderate number. For example, interviewee 26 was classified as combination-low as she had 13 messages in her inbox and 6 folders (see Figure 6.3, top right). Seven people were judged to be inbox centric, for example, interviewee 31 had 859 messages in his inbox but only one folder. Four people were classified as folder centric, such as interviewee 10, with 14 messages and 68 folders.

Interviewees were asked to provide reasons for their e-mail screen configurations, as well as providing the researcher with a screen shot of their configurations. All but one of the 23 interviewees had made one or more changes to the configuration of the screen. A prominent configuration change was to turn-off the reading pane (11), which by default was the right pane of the screen (see interviewee 31, Figure 6.3): *"I don't like seeing the body of the email, I like to identify very quickly"*, and *"I found the preview pane to be redundant… can see who and subject [in the header], which gives me enough info without the preview pane"*. A further six people had changed the location of the reading pane to the bottom of the screen. Other configuration changes included turning off the "Show in Groups" function, which groups emails by time (yesterday, last week etc), turning on "AutoPreview", which shows the first few lines of messages below the header, adjusting the width of panes, and resizing of the outlook window to take up less of the screen: *"AutoPreview is on. Viewing pane is off. That is quite deliberate. First three lines is enough for me to know what it is, particularly if people have been clever enough to put info in first three lines….allows me to scan a reasonable number in one hit*". However, only 14 of 22 people who made changes were aware that they had done so. This was determined by comparing interviewees screen shots against the default screen configuration for Outlook e-mail. For example, interviewee 31 was using the default pane layout, but had changed the message sort order to sort by the "From" field, and interviewee 10 had turned off AutoPreview (see Figure 6.3). A related issue was whether or not people believed their configuration was the default. Ten interviewees declared their configurations were the default, but only one person was correct in making this claim. The difficulty these nine interviewees had in remembering if changes had been made suggests that they were performed some time ago, perhaps soon after the initial installation in 2005. Four of these individuals had changed the preview pane to the bottom but still believed it to be the default configuration. Another individual had turned the reading pane off but believed this to be the default.

E-mail similes were generated by asking respondents to complete the question "e-mail is like…" Fourteen people provided responses to this question, with 12 of these providing similes that conveyed ambivalence toward e-mail. For example, four people saw e-mail as a *"necessary evil"*:

> "*it provides a useful, necessary function for information exchange in a large diverse and spatially distributed organisation, but because of its ubiquitous usefulness there is a vast amount of information flowing through email…big impact on time"*.

Three people likened e-mail to a "*double-edged sword"*:

> "*as a tool it can be extremely useful, it can save time, forces better expression due to act of typing… On the other hand, if I don't add the extra discipline of time management it could easily eat up 50% of my time"*.

Other similes included:

- *"Email is like a less than palatable meal, when you are hungry you need [it], but in a normal state [it] is an unpleasant thing to deal with."*
- *"[It is] like a long relationship where I am still on first base. I am cautious and it is due to my cautiousness and my own fumblings and inexperience. But at the same time it would be nice if email came to the party a bit more."*
- *"[Like a] bull in china shop. A large and often unwieldy system that is not always used appropriately."*

Ten people likened e-mail to another medium or communication channel, in particular writing letters (5), having a conversation or talking on the phone (2), and both writing and talking combined (3): "*e-mail is like a fast forwarded, nitro burning version of letter writing"*; like *"telephone with words"*; and like a *"more formal version of conversation, but a less formal way of conversing than in a letter"*.

Seven people provided negative similes about e-mail. A couple of people likened it to a drug: *"you get anxious if you haven't had any access to email, because you don't know what is going on. Usually there is nothing going on [but there is] a feeling of missing out on information."* Other interviews saw e-mail as like:

- *"a snowball, I am getting rolled….never finishing business"*.
- *a "scourge on modern society …despite it being a comms tool it leads to a lot of miscommunication and misunderstanding"*.
- *"a bunch full of distractions…I am easily distracted and find that it fragments my day"*.
- *"those things you see, those places with those big things filled with round balls. [People] climb around and don't get anywhere"*.
- *"a bit of a disease"*

The disease simile was employed by another interviewee, but was instead construed positively: e-mail is like a *"plague going out across the world in a good way. It spreads and it is a bit addictive. Bing – a distraction, oh good"*. Three other interviewees also provided

positive similes, for example, e-mail is like *"a cup of tea in the morning….It is regular, it is good for you if done well, and you can try out a few options"*.

6.4.2 Quantitative data analysis

Quantitative data from the questionnaires and interviews were analysed using descriptive and inferential statistics. The descriptive statistics identified general themes and issues. Data from the follow-up questionnaire was analysed using correlation analysis to determine significant relationships between influences and measures of appropriation. Internal consistency reliability coefficients (Cronbach's alpha) for all the multi-item measures were calculated and ranged from 0.50 to 0.89 (see Table 6.6 and Table 6.7). The values for habitual use (0.50) and nature of IS use (0.54) were too small to justify inclusion as multi-item measures. Therefore, a single item from each scale was selected to support inferential statistics, based on the item with the greatest range of values. The habitual use item selected was "the use of e-mail has become a habit for me" (range = 5). The nature of IS use item selected was "I try new features in the e-mail application to make me more efficient than others" (range = 4).

6.4.2.1 Influences on appropriation

Influences on the appropriation of e-mail were identified by generating a correlation matrix using pair-wise deletion of missing data, as well as through calculating descriptive statistics. The complete descriptive statistics and correlation matrix are contained in Appendices D.7 and D.8. The correlation analysis showed that there were no significant correlations for the belief and attitudinal influences (see Table 6.5). For the contextual influences, age and attitudes towards computers in general were significantly correlated with self-assessments of e-mail experience. Competence was also related significantly with the nature of IS use (try new features item).

	Volunt-ariness	Habitual use	Nature of IS use	Email exp.	Messages sent	Messages received	Inbox	Folders
Contextual influences								
Gender	0.42	0.03	0.28	0.00	-0.01	-0.13	-0.42	0.43
Age	0.10	-0.08	0.38	0.57*	-0.32	-0.36	0.17	0.38
Time at DSTO	-0.19	0.21	0.42	0.00	-0.24	-0.45	0.18	0.31
Number of staff	-0.37	0.11	0.18	0.02	0.26	-0.02	0.23	-0.1
General attitudes	-0.03	-0.24	0.49	0.53*	0.21	-0.03	0.09	0.15
Competence	0.27	-0.20	0.66**	0.49	0.02	-0.10	0.12	0.18
Influences								
Demands	-0.48	-0.10	-0.37	-0.10	0.09	-0.01	0.18	-0.02
Usability	0.44	0.26	0.44	-0.12	-0.17	-0.09	0.48	-0.05
Ease of use	0.23	-0.12	0.14	0.04	0.29	0.06	-0.07	0.04
Design	0.15	0.12	0.14	-0.10	0.25	0.24	0.14	-0.13
Usefulness	0.10	0.39	0.31	-0.12	0.07	0.18	0.20	-0.25

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.5 Intercorrelations with measures of appropriation: follow-up phase

The descriptive statistics for the follow-up phase are summarised in Table 6.6. A large majority of respondents had positive views about e-mail with respect to its usability, ease of use, system design and usefulness. They also saw e-mail as placing limited demands on them. General attitudes toward computers and competence provided an assessment of the wider context. The large majority were positive about computers in general and also judged themselves to be competent users of e-mail.

	(Alpha coeff)	N	Min	Max	Mean	SD	%>3	%<3
Contextual influences								
General attitudes	0.89	16	2	5	3.93	0.77	94	6
Competence	0.83	16	2	5	3.69	0.70	88	6
Influences								
Demands on users	0.86	16	1	3.67	2.00	0.85	6	81
Usability	0.67	16	3	4.22	3.60	0.40	94	0
Ease of use	0.83	16	2	5	3.78	0.73	81	6
Design	0.87	16	2	4.67	3.63	0.59	88	6
Usefulness	0.86	16	2.60	4.60	3.64	0.61	81	13

Table 6.6 Descriptive statistics: influences on appropriation – follow-up phase

6.4.2.2 Patterns of appropriation

Patterns of appropriation were investigated using a variety of measures listed in Table 6.7. There was a spread of responses to the query about voluntary use. Six respondents did not see

their use of e-mail as voluntary, four did, and six were ambivalent. Seventy-five percent (12/16) of respondents agreed or strongly agreed that their use of e-mail had become a habit, with two people disagreeing. The nature of respondents' e-mail use was conservative, with the majority (69%) of respondents indicating they tended not to try new features in e-mail to make them more efficient than others. Respondents were asked to rate how experienced they considered themselves to be with using e-mail. Forty one percent (16/39) of participants in the initial phase assessed themselves as intermediate and 59% (23/39) as advanced. For the follow-up, 50% self-assessed as intermediate and 50% as advanced.

	(Alpha coeff)	N	Min	Max	Mean	SD	%>3	%<3
Appropriation								
Habitual use	0.50	16	2	5	3.78	0.75	75	6
use of e-mail become a habit		16	1	5	3.75	1.06	75	13
Nature of IS use	0.54	16	2	3.67	2.69	0.48	19	69
try new features to make me more efficient		16	1	4	2.31	0.70	6	69
Voluntariness	-	16	1	5	2.88	1.20	25	38
Email experience	-	16	2[30]	3.5	2.50	0.55	-	-
Messages sent	-	23	3	30	9.43	6.65	-	-
Messages received	-	23	3	80	20.61	18.08	-	-
Inbox	-	23	13	11014	1812.48	2736.12	-	-
Folders	-	23	0	320	87.57	101	-	-
Check e-mails	-	23	6	6	6	0	-	-
File e-mails	-	21	1	6	4.33	1.74	-	-
Years of use	-	21	4	28	15.23	6.12	-	-

Table 6.7 Descriptive statistics: measures of appropriation

The extent of appropriation of e-mail was assessed by asking interviewees to estimate how many e-mails they sent and received on average each day. People received an average of 21 messages per day, with a range from three to 80. People sent nine messages on average, with a range of three to 30. Figure 6.4 shows the combined number of messages sent and received for each interviewee. It can be seen that there was considerable diversity across individuals. The extent of appropriation was also assessed by getting estimates of the number of times per day e-mail was checked, as well as how frequently e-mails were filed[31]. All interviewees checked e-mail a few times a day or more on average. Nine of 21 people filed e-mails several times per day, with one person not performing any filing. The remainder ranged from a few times a year through to once a day. The amount of time spent using e-mail, relative to other

[30] 1 = beginner; 2 = intermediate; 3 = advanced; 4 = expert

[31] Interviewees responses to this question were recoded on a six point scale ranging from "never" through to "several times per day".

communication channels, was assessed as part of using the repertory grid technique. The three top-ranked channels were face-to-face (mean ranking =1.53), e-mail (m=1.82), and phone (m=2.71). Sixteen of the 17 people who completed the repertory grid ranked e-mail first (n=5) or second (n=11).

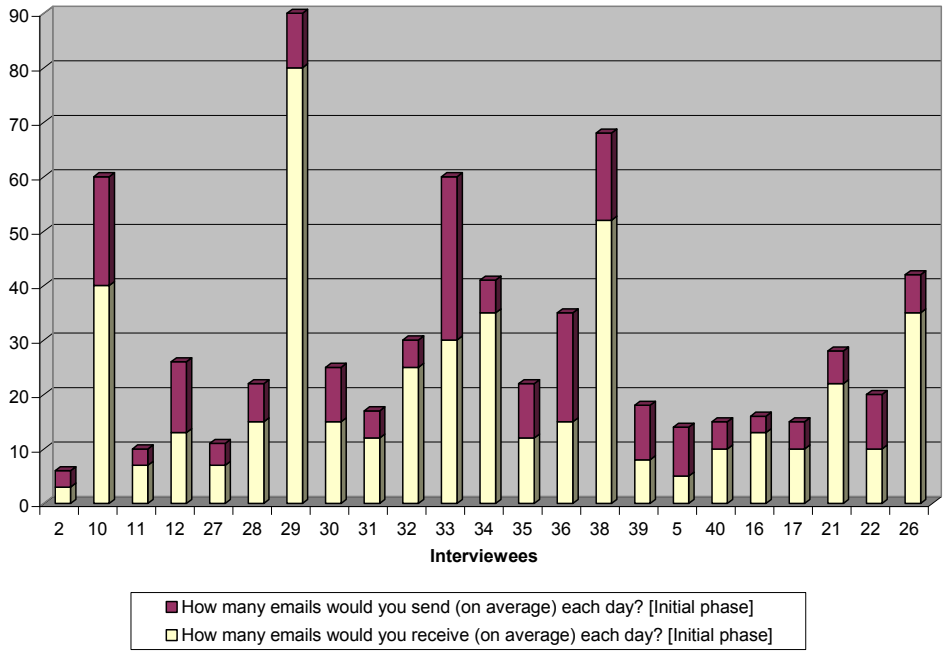


Figure 6.4 Number of e-mails sent and received: initial phase

Some of the ways in which interviewees managed and responded to e-mails were revealed through investigating the number of e-mails in the inbox and the number of e-mail folders (see Table 6.7). The number of e-mails in the inbox ranged from 13 to 11014 with an average of 1812. Interviewees averaged 88 folders and ranged from zero to 320.

6.4.3 Influences and patterns of appropriation over time

6.4.3.1 Influences and patterns of appropriation over time - quantitative

Sixteen people contributed to data collection in both phases of the study. Quantitative data were derived from interviews and questionnaires. Descriptive and inferential statistics were used so as to investigate changes in beliefs, attitudes and behaviours over time.

A. Changes in influences over time

Changes in influences over time were assessed by examining correlations between influences and years of use (see Table 6.8). All but one of the contextual influences (gender) were

significantly different over time. None of the belief and attitudinal influences were significantly different.

	Years of use
Contextual influences	
Gender	0.17
Age	0.56*
Time at DSTO	0.55*
Number of staff	0.59*
General attitudes	0.64**
Competence	0.63**
Influences	
Demands on users	0.03
Usability	0.04
Ease of use	0.25
Design	0.13
Usefulness	-0.05

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.8 Intercorrelations with years of use: follow-up

B. Changes in patterns of appropriation over time

Appropriation measures were correlated with years of use to identify changes in patterns of appropriation over time (see Table 6.9). The nature of IS use was correlated significantly with years of use.

Appropriation measures	Years of use
Habitual use	-0.07
Voluntariness	0.15
Nature of IS use	0.71**
Email experience	0.42
Messages sent	0.14
Messages received	-0.19
Inbox	0.11
Folders	0.45

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6.9 Intercorrelations: appropriation measures and years of use – follow-up

Changes and stability in users' patterns of appropriation were identified through reviewing the descriptive data and via a correlation analysis comparing individuals responses at the initial interview compared with their responses at follow-up. Large significant correlations are indicative of limited change over time, with small non-significant findings indicative of change.

The extent of use of e-mail was assessed in both interviews. Figure 6.5 shows the number of e-mails received by 16 users at two time points separated by an average of 19 months. There were no consistent trends in messages received, with some people experiencing an increase and some experiencing a decrease, and some little or none. However, in absolute terms the average difference in messages received was 16. A correlation of 0.07 ($p=0.80$) shows that this change was substantial over time. The number of e-mails sent was more consistent, with little difference between the two time points (see Figure 6.6). The absolute difference in messages sent was an average of 2 messages with a correlation of 0.94 ($p<0.001$) confirming that the number of messages sent was very stable over time. No changes were seen in the frequency with which e-mail was checked between the two time points, and only minimal changes overall in filing frequency ($r=0.81$, $p<0.001$). However, four people did describe changes in frequency with one person indicating a reduction and three an increase in filing frequency.

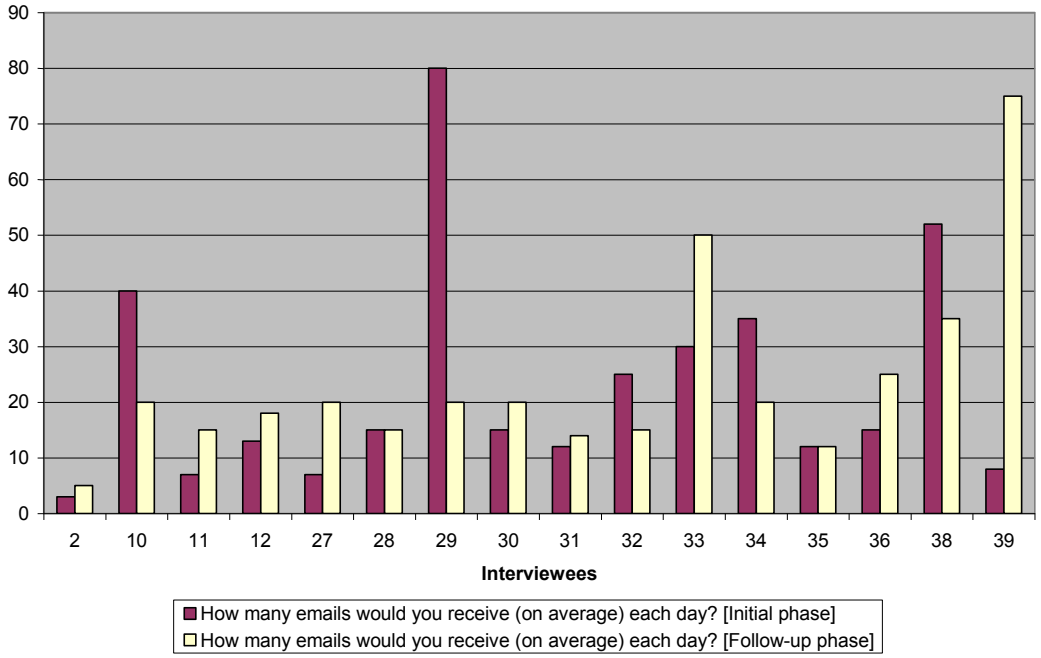


Figure 6.5 Number of e-mails received over time

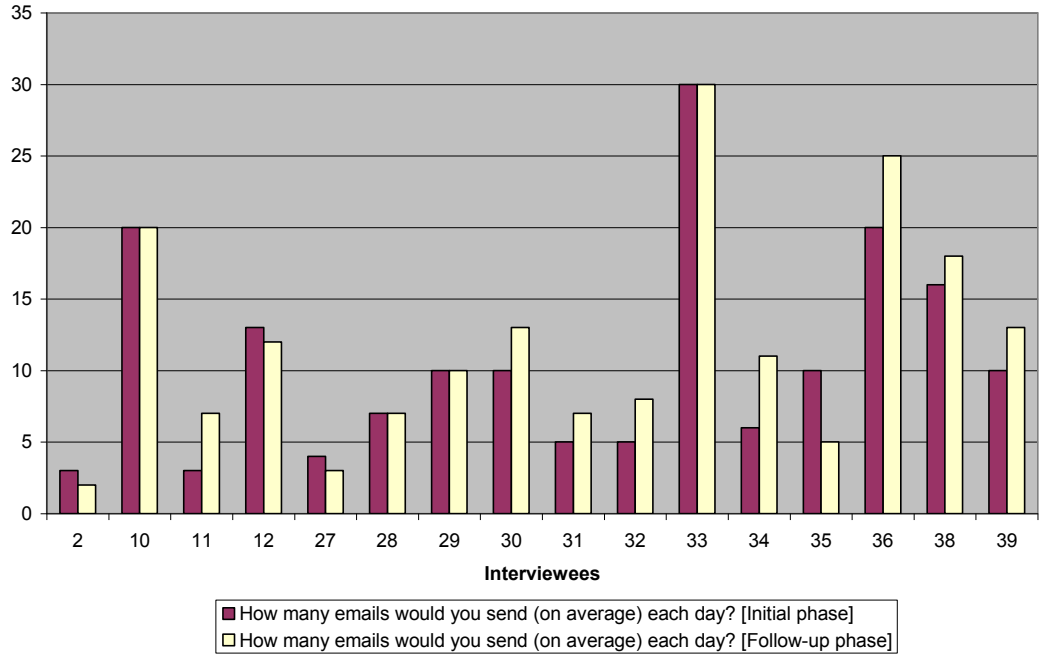


Figure 6.6 Number of e-mails sent over time

Overall, changes in the management of e-mails were minimal, with the number of e-mails in inboxes between interviews correlated 0.78 ($p<0.001$), and number of folders correlated 0.97 ($p<0.001$). However, one individual experienced a substantial change, with an increase in the size of their inbox by over 10000 messages. With this person removed the correlation was 0.97 ($p<0.001$).

6.4.3.2 Individual level analysis of influences and patterns over time

Qualitative and quantitative data from the interviews were analysed to identify any changes in individual's patterns of appropriation over time and influences on these changes. In addition, each interviewee was then categorised according to the extent of changes observed and described, and whether or not they had made adaptations to e-mail, associated practices, or both. Results from the 16 interviewees who participated in both initial and follow-up interviews are summarised in Table 6.10, with *reasons for changes highlighted in italics*.

Interviewee ID	Nature of changes and *reasons*	Extent of changes	Adaptation to e-mail (T) and/or practices (P)
2	Change to archiving configuration.[32]	S	T
10	Reduction in messages received *due to 1st interview involving job transition*. More frequent access to e-mail *due to external broadband access*. Less navigation pane tabs showing.	M	T/P
11	Change in filing behaviour from daily to fortnightly + associated substantial increase in inbox size *due to wondering why she was saving every attachment to a network drive*. Recently started turning e-mails into tasks as she *felt there were things she shouldn't forget*.	L	P
12	Use of MS Communicator *as informal communications tool for lunchtime walking group + hadn't checked e-mails on day of interview* re: inbox size.	M	P
27	Increase in messages *due to Uni messages*.	S	P
28	Filing changed from one e-mail per week to multiple per day *due to increased variety of responsibilities*. Inbox increased in size as *haven't cleared out in quite a long time* Removal of Find menu bar.	L	T/P
29	Significantly less volume of emails + more concerted effort to keep up with messages *due to not acting in a more senior role anymore*	L	P
30	*Increase in workload and responsibility (and associated travel)* leading to increased send/receive + decreased filing frequency + increased checking of e-mail when in office. Inbox increase simply *time related - approach hasn't changed.* Addition of Advanced menu bar.	M	T/P
31	Inbox size increased substantially *due to change in communications associated with task team.* Less messages in deleted items (not automatically purged), *purged accidently once with little consequence*, now keep smaller. Changed to arrange by Date (previously From) + search *due to increase in inbox size and message volume*	L	T/P
32	Reduction in messages received *due to increased filters + improved spam filter*. Increase in folders *due to wanting to be more organised*, more folders with less in them. *Trying to be more efficient* by not leaving some messages unread. Increased font size *to improve readability*. *Accidental bulk deletion*, followed by conscious bulk del., since *no consequences* in first instant (prior to 1st interview). Dialup access - check daily if away *to avoid build up*.	L	T/P
33	Increase in receipt *due to more responsibilities, and more contacts by email.* Increase in folders - file better now, delete less making it easier to search. W*as caught out a couple of times re: not being able to show others a message.* Change in practices re: keeping messages as record of actions *due to increased responsibilities*. Tried colour coding by important senders *after getting idea from another user in work area*. *Largely in disuse as coding didn't influence message handling as intended*. Increased size of Reading Pane (Bottom)	L	T/P

[32] Refer appendix D.6 for a summary of the types of changes in appropriation patterns for each interviewee.

Interviewee ID	Nature of changes and *reasons*	Extent of changes	Adaptation to e-mail (T) and/or practices (P)
34	*Couldn't think of reason* for reduction in messages received. Increase in filing frequency, but perception was that frequency had decreased *due to being lazy.* Reduction in inbox size *due to clean up*. Addition of Find menu.	M	T/P
35	More of a tendency to ignore messages - *work more intriguing*. Inbox gone up *due to not deleting but no change in policy*	S	P
36	Sent/received increased *due to broader role (new job) involving more communication*. Had to be a lot more regimented on cleaning *due to "Mailbox over limit" messages*. Reduction in folders because he *lost all his folders due to technical problem* - had to "rebuild my life from scratch". Use of higher classification e-mail system as well as normal system - *due to change in job role*. Reading Pane (Bottom) smaller.	L	T/P
38	Perception of 10-15% drop in e-mail messages *due to use of Skype Instant Messenger*. *Initially cost was a factor (re: voice functionality) then polite way of checking if O/S colleague available to talk. Also because short messages and time critical*. No longer file internal correspondence *due to enterprise vault* (only every couple of months previously) Massive increase in inbox volume due to archived messages being transferred back in -*due to enterprise vault*. Decreased checking frequency + more urgent stuff via Instant Messenger - *in part affected by turning off reminders (which the researcher did for him during 1ST interview)*.	L	P
39	Substantial increase in messages sent/received *due to greater involvement and increased responsibilities in role.* Previously, had just started in new role. Increase in filing but somewhat haphazard -*influenced by researcher.* Increase in inbox but unclear if due to change in practice Sorting by Conversations occasionally. Greater use of Calendar *due to more meetings with multiple people*. Reduced width of Messages Pane	L	T/P

Table 6.10 Changes in appropriation patterns and reasons for changes

A. Influences on changes in patterns of appropriation

The reasons for changes in patterns of appropriations were diverse. Ten interviewees explained variations by reference to changes in their work responsibilities or the nature of their work: *"My job is much more of a people orientated role…[it] involves me having to use email more…[Previously had a] very limited task focussed sort of role…Now very broad"*. Four interviewees had engaged in considered action informed by reflection on extant practices. For example, interviewee 11 indicated she sometimes turns *"emails into tasks, if they are "to do" things… Only just started doing that…about two weeks ago. I just thought there were a few things that I just shouldn't forgot, and if I left them in inbox or filed them I would forget them. I thought I wonder if I drag that [the message] onto tasks it would become a task, and it did, and that was good"*. Various accidents and incidents were identified by four people as influences on adjusting their appropriation patterns: *"You will notice in my deleted items I only have 15 items. I am getting pretty good at purging those. One of them was not my own plan, I got [a system message]….selected yes and it deleted everything. The sky didn't fall in, so why not, can be a little more ruthless in culling things"*. Additional types of influences were: other technologies (3 interviewees), such as the use of instant messaging for some communications previously performed using e-mail; other people (3), such as the researcher demonstrating how to do things like turning off alerts; and the volume of e-mails (3).

B. Changes in patterns of appropriation over time

All of the 16 interviewees reported some change in extent of appropriations. Three interviewees experienced small or minor changes (S) (refer column second from right of Table 6.10), such as an increase in messages received due to starting a university course. Moderate changes (M) were described by four people, for example, the use of instant messaging for some informal communications instead of e-mail following its introduction into DSTO. A further nine individuals experienced large changes (L), such as one individual (38) who:

- was using instant messaging for shorter, more immediate communications;
- had moved all of his archived message dating from 2002 back into his inbox, as well as no longer filing internal correspondence, due to the introduction of a corporate e-mail management and archiving system (Enterprise vault); and
- had decreased his frequency of checking due to turning off alerts following his first interview with the researcher.

In addition, data were analysed to determine who had engaged in adaptation to the IT artefact (e-mail) (T) and/or associated practices (P) (refer right hand column of Table 6.10). Adaptations included customisations, changes in features employed, and changes in communications and information management practices. Nine interviewees were assessed as adapting both the e-mail application and associated practices (T/P). For example, interviewee 28 had changed the configuration of e-mail between interviews by removing the Find menu bar. He had also changed his filing behaviour from approximately one e-mail per week to multiple per day due to being responsible for a wider range of activities. Six people had made changes to their practices but not to the e-mail application (P). Interviewee 11, for example, had reduced the frequency of her filing from daily to fortnightly and had also stopped saving every attachment to a network drive, instead just saving the *"important stuff"*. She reflected that this practice was *"too time consuming"* and had wondered *"why am I doing this? If I don't really need this file I will just leave it in an email as an attachment and figure it has been archived somewhere"*. There was only one person (interviewee 2) who made an adjustment to e-mail, by changing the archiving configuration, but had not changed their practices (T).

One aspect of users' e-mail appropriations was quite stable over time, the type of e-mail management approach they employed. Eleven of 13 interviewees were found to have the same e-mail management approach between interviews.

6.5 Contextualising the MTA for the e-mail case

In this section, the qualitative and quantitative analyses are combined and summarised so as to enable contextualisation of the MTA for the e-mail case.

6.5.1 Influences on appropriation over time: adaptation and stabilisation

The e-mail case investigated the adaptation and stabilisation phases of the appropriation process. Analysis of the qualitative data showed that participants held positive views about the functionality of e-mail, such as the automatic creation of a record (see Table 6.11). Its usability (speed, ease of use, etc) was also viewed as quite positive. Views were more mixed about the usefulness of e-mail. For example, it provides more time for considered responses but it is difficult to manage information. Participants were negative about adherence to social norms, as evidenced by people sending spam. They also felt that e-mail had some

shortcomings with respect to mediating social interactions, such as the absence of non-verbal cues. A diverse range of contextual influences were raised as reasons for changes in users' patterns of appropriation between interviews including: changes in work responsibilities or the nature of work, reflection on practices, accidents or incidents, other technologies, other people and the volume of e-mail (see Table 6.11).

	Valence
Influences	
Functionality	✓
Usability	✓
Usefulness	✓/×
Social norms	×
Social mediation	×
Contextual influences	
Changes in work responsibilities or nature of work (10)	
Informed by reflection on extant practices (4)	
Accidents/incidents (4)	
Other technologies (3)	
Other people (3)	
Volume of e-mail (3)	

✓ = mainly positive; × = mainly negative; ✓/× = mixed; ~ = insufficient data

Table 6.11 Influences on appropriation over time (qualitative)

Two of the influences identified in the qualitative analysis were also examined in the follow-up questionnaire: usability and usefulness (see Table 6.12). The large majority of respondents were positive in their ratings for perceived usefulness, which was somewhat inconsistent with the qualitative results. This was perhaps because views about usefulness were far more specific than the items used in the questionnaire measures, thereby providing a more nuanced assessment. The questionnaire also assessed additional influences. The majority of respondents had positive attitudes toward computers in general, assessed themselves to be competent users of e-mail and did not see e-mail as placing demands on them from a technical perspective.

Influences	Inferential statistics	Descriptive statistics (%)
Age	Email experience (*); Years of use (*)	-
Time at DSTO	Years of use (*)	-
Number of staff	Years of use (*)	-
General attitudes	Email experience (*); Years of use (**)	✓ (94,6)
Competence	Nature of IS use (**); Years of use (**)	✓ (88,6)
Usability		
-Look and feel (GUI), performance, navigation	~	✓ (94,0)
-Ease of use	~	✓ (81,6)
-Design	~	✓ (88,6)
Usefulness	~	✓ (81,13)
Demands on users	~	✓ (81,6)

✓ = mainly positive (%>3); ✗ = mainly negative (%<3); ✓/✗ = mixed; ~ = not significant
**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table 6.12 Influences on appropriation over time (quantitative): follow-up phase

A correlation analysis identified statistically significant influences on measures of appropriation, as well as significant changes in influences over time (via the 'years of use' measure) (see column 2 of Table 6.12). Three of the eight appropriation measures had significant correlations: e-mail experience, nature of IS use, and years of use. Older users and those with more positive attitudes towards computers in general rated themselves as more experienced users of e-mail. Respondents who judged themselves as competent e-mail users were inclined to use e-mail differently than others (nature of IS use). Older respondents, those who had spent more time at DSTO, people with supervisory responsibilities, those with positive attitudes towards computers in general, and with self-assessments of competence also were more likely to have used e-mail for longer. This later result also suggests that attitudes towards computers in general and perceptions of competence increase over time.

6.5.2 Patterns of appropriation over time: adaptation and stabilisation

Years of use was correlated with the other measures of appropriation to identify changes in appropriations over time. The results suggested that users were less conservative in their approach to using e-mail (nature of IS use) with more years of use, although a majority of users were conservative (see 'unstable patterns over time' section of Table 6.13).

Appropriation measures	Patterns
Unstable patterns over time	Nature of IS use: less conservative with greater years of use Changes in extent of appropriations: small/minor (3); moderate (4); large (9) Adaptations to: e-mail (1); practices (6); both (9) Messages received
Stable patterns over time	Messages sent Frequency of checking e-mails Filing frequency: only 4 people with differences Inbox size Number of folders Type of e-mail management: 11 of 13 same
Quantitative	
Nature of IS use	69% (11 of 16) conservative users
Voluntariness	Ambivalent (6); Not voluntary (6); voluntary (4)
Habitual use	75% (12 of 16)
E-mail experience	Initial: 41% intermediate; 59% advanced Follow-up: 50% intermediate; 50% advanced
Messages sent	3 to 30 per day (9.43)
Messages received	3 to 80 per day (20.61)
Check e-mails	All respondents checked several times per day
File e-mails	Never through to several times a day (on average, a few times a week or more).
Inbox size	13 to 11014 (1812.48)
No. of folders	0 to 320 (87.57)
Years of use	4 to 28 years (mean = 15.23)
Qualitative	
Inbox/folder ratio	Three types of e-mail management: inbox centric (7); folder centric (4) and combination (12)
Daily rhythms of use	Wholly or in part: message receipt (18); checking at set times (13); and sporadic checking (7).
Voluntariness	Ambivalence (8 of 13); not discretionary (3); discretionary (2)
Habitual use	Habitual: 9 of 12;Unsure: 3
Screen configurations	All but 1 person had made changes to default settings Only 14 of 22 people who made changes were aware they had done so
E-mail similes	Ambivalence (12 of 14); like another channel/ICT (10); positive similes (4); negative similes (7)

Table 6.13 Patterns of appropriation over time

A comparison of appropriations between the initial and follow-up interviews identified a significant change in the absolute number of messages received. After querying individuals about changes between interviews it was found that all 16 had changed the extent of their appropriations in some way. Furthermore, all of them had engaged in adaptations to their practices associated with e-mail use, the application itself, or both. Some aspects of users' appropriations were stable over time, including messages sent, frequency of checking e-mails, filing frequency, and type of e-mail management (inbox size, number of folders, and inbox/folder ratio).

Analysis of the quantitative data showed that the majority of users saw their use as habitual and their levels of e-mail experience as advanced (see quantitative section of Table 6.13).

Views were more diverse for perceptions of voluntariness with people seeing their use as voluntary (4), not voluntary (6) or expressing ambivalence (6). All interviewees checked their e-mail several times a day and nine of 21 people filed their e-mails several times per day. However, filing frequency for other respondents ranged from never through to once a day. Heterogeneous patterns of use were also noted for messages sent, messages received, the number of messages in the inbox and number of folders.

Despite the heterogeneity in patterns of use, users' e-mail management approaches and daily rhythms of use were able to be classified into qualitatively different types (see qualitative section of Table 6.13). Three broad types of e-mail management were identified: inbox centric, folder centric and a combination of both. Rhythms of use could be described by one or a combination of: responding when messages received, checking at set times, or checking sporadically during the day. Message receipt was the most prominent influence since only five of the 23 interviewees had turned off the new mail desktop alert pop up. Comments about habitual use and voluntariness were quite consistent with the quantitative findings. The exception to this was four individuals who provided comments that suggested ambivalence but whose ratings indicated otherwise. The qualitative data also provided insights into the reasons for ambivalence; use was not mandated but organisational practices made them captive users. Twenty three interviewees supplied screen shots of their e-mail screens and were asked to provide reasons for their configurations. All but one of them had made changes to the default settings, such as turning off the reading pane. However, eight interviewees were unaware they had made any changes. E-mail similes offered by 12 interviewees conveyed ambivalence towards e-mail. Ten interviewees likened e-mail to another communications channel or information and communications technology (ICT). Four people provided positive similes and seven provided negative similes.

6.5.3 The MTA contextualised for the e-mail case

The MTA was contextualised to capture the findings from the e-mail case (see Figure 6.7). This case investigated the adaptation and stabilisation phases of the appropriation process. Contextualisation was achieved by overlaying context specific influences and patterns onto the generic MTA, which are contained in the boxes surrounding the generic model. The contextualised model summarises the qualitative and quantitative analyses from the e-mail case under four key headings: influences on appropriation, patterns of appropriation, influences over time and patterns over time.

Influences on participants' patterns of appropriation are presented in the two top left boxes of Figure 6.7, with patterns of appropriation presented in the top right box. The ticks '✓' in the influence box denote responses that were mainly positive, with the crosses '✗' indicating mainly negative. The numbers in brackets denote particular measures of appropriation. Correlation analysis was used to determine the strength of relationships between influences and measures of appropriation. For example, competence was significantly correlated with nature of IS use '(1)'. Changes in influences and patterns of appropriation over time were also examined and are summarised in the bottom right box, as well as evidence of stability for some aspects of users' appropriations.

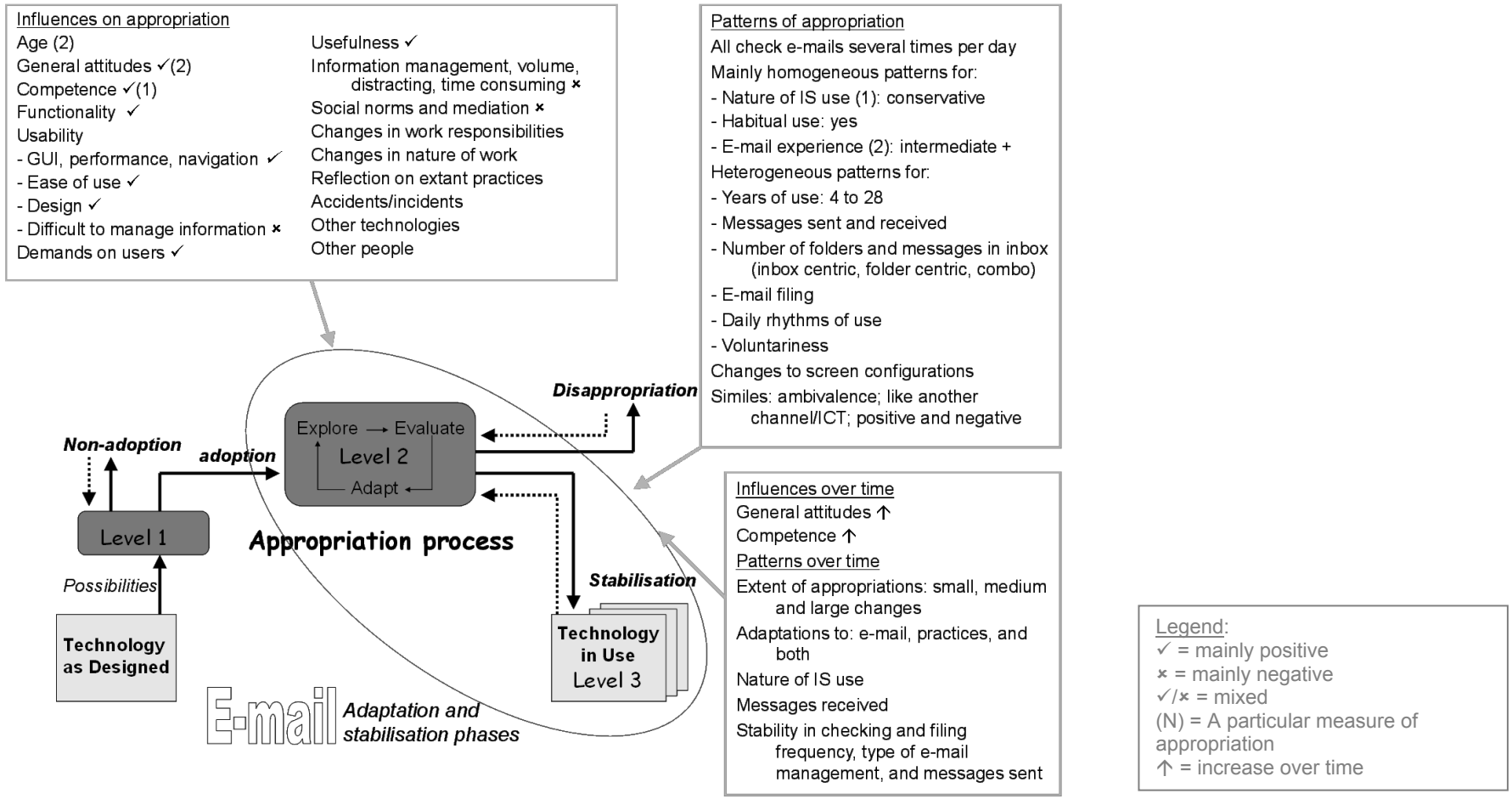


Figure 6.7 The MTA contextualised for the e-mail case

6.6 Generative mechanisms

Van de Ven and Poole (1995) identified four generative mechanisms: lifecycle, teleology, dialectics and evolution. The results from this case will now be considered from the perspective of each of these mechanisms.

6.6.1 Lifecycle

In DSTO, e-mail is a mature technology that is thoroughly incorporated with peoples' practices to become a 'technology in use'. Furthermore the amount of exposure to this technology was substantial and ranged from four to 28 years. In the MTA, 'technology in use' is associated with stabilisations in patterns of appropriation. Whilst certain patterns showed evidence of stability, such as e-mail management and filing frequency, there was widespread evidence of adaptations, some of which were substantial. The association between stabilisations in patterns of appropriation and 'technology in use' is therefore problematic. Findings from this case indicate that both adaptations and stabilisations in users' patterns of appropriation are manifested, even in situations where a technology is thoroughly integrated with users' practices.

Another source of evidence of adaptations was the substantial heterogeneity in patterns of appropriation across individuals. As Mackay (1988) found in her study more than 20 years ago, the "use of electronic mail is strikingly diverse, although not infinitely so" (p. 344). This supports the multiple 'technologies in use' in the MTA (the tiled boxes to the right of the model).

There was no evidence of disappropriations or partial appropriations in this case, since all participants checked their emails several times per day and used it as an integral part of their work practices.

6.6.2 Teleology

A multilevel examination of teleology was undertaken providing an assessment of individual and organisational goals associated with use of e-mail (Jasperson et al. 2005; van den Hooff 2005). During the data collection for this case, DSTO made investments in two technologies designed to assist users in managing e-mails (Enterprise Vault) and to communicate via

computer more dynamically (MS Communicator (instant messaging)). Enterprise vault was introduced to assist DSTO in meeting its archiving responsibilities and to enable staff to archive and manage their messages. MS Communicator was deployed in an effort to provide staff with modern office communication technologies. These investments clearly influenced some users' patterns of appropriation, such as interviewee number 12 who had moved to using MS Communicator for social communications in the workplace.

A range of belief and attitudinal influences were assessed in this case, such as usability and usefulness. None of these influences was significantly related with any of the measures of appropriation. This is perhaps due to much of e-mail users' appropriations not being goal directed but determined by habitual routines, such as rhythms of use, as well as by contextual influences, such as the nature of a job. This finding is consistent with the proposition put forward by Venkatesh et al. (2003) that influences such as ease of use and usefulness may be less likely to apply where behaviour is generated by routinised responses, rather than resulting from deliberate cognitions. Nevertheless, there was widespread evidence from the interviews that many of the participants had acted intentionally when changing their patterns of appropriation. The reasons given for making intentional changes included reflection on extant practices associated with e-mail use, the introduction of other technologies, and the patterns of use and suggestions of other people.

Reflection on these findings suggests that for technologies that are thoroughly incorporated with practices, the ability to identify if users have acted intentionally is influenced by the particular method employed. Sole dependence on rating scale surveys could lead to erroneous conclusions about the absence of intentionality in such use contexts. An additional implication is that habit and intentionality can co-exist. An individual might employ a consistent daily rhythm of use, but at the same time engage in intended adaptations to their use practices.

A teleological perspective draws attention to the purposeful pursuit of goals. Prior research has found that e-mail in not only "strikingly diverse" but that it also supports multiple goals (Wattenberg et al. 2005). The current study similarly found that e-mail supports a wide variety of goals such as communication, information management, and information sharing.

6.6.3 Dialectics

Dialectic process theory explains stability and change as the outcome of tensions between opposing or competing entities (Van de Ven & Poole 1995). Tensions were analysed at the level of the e-mail artefact, and at the level of users' practices and associated technologies. Interviewees were asked to generate e-mail similes. Ambivalence toward e-mail was a prominent feature of these similes. For example, it is a "necessary evil" that supports information exchange (thesis) but which also has a big impact on time (antithesis). Ambivalence represented the emotional synthesis resulting from tensions between the affordances (thesis) and constraints (antithesis) of e-mail.

As has been discussed, e-mail supports a variety of goals associated with communications, information management and information sharing (the thesis). There are other channels and technologies that also support the fulfilment of these goals, particularly face-to-face and telephone (the antithesis). The use of e-mail, face-to-face, phone and other means of communication therefore provided users with a portfolio of channels and technologies to support the fulfilment of these goals (the synthesis).

Two technologies associated with communications and information management were introduced during the data collection phase of this case: Enterprise Vault and MS Communicator. These technologies represented the antithesis to the existing portfolio of technologies and practices associated with e-mail (the thesis). Enterprise Vault was deployed to all desktops, with users having the option of installing MS Communicator. Some individuals embraced these new technologies by incorporating them into their portfolios, as well as by adjusting their practices. The incorporation of the technologies with existing portfolios represented a synthesis. Also apparent were substitutions in functionality or affordances. Activities such as informal communications and archiving that were previously undertaken using e-mail were now performed using new technologies. For example, one individual moved all of his archived messages back into his inbox so that they would all be located in the one place, with archiving of the inbox now done automatically by Enterprise Vault, which in turn facilitated easier searching. Another individual had substituted e-mail with MS Communicator to support informal communication and coordination amongst a walking group. The majority of other participants had not changed the location of their folders to their inbox to take advantage of the capabilities of Enterprise Vault, instead maintaining folders on their local PC or on a shared drive. They also had not installed MS Communicator.

6.6.4 Evolution

Evolution entails a continuous cycle of variation, selection and retention. Processes of variation and selection are associated with adaptations, retention is associated with stabilisations. All of these processes were manifested in this case.

Variations result from unpredictable events. Four interviewees identified accidents and incidents as influences on changes to their patterns of appropriation. One individual had previously kept all deleted items just in case he needed them, but accidentally deleted them one day and "the sky didn't fall in". From this point on he decided to be "a little more ruthless in culling things". Similarly, another person had accidentally bulk deleted the messages in her inbox with no consequences. She subsequently decided to consciously bulk delete messages. Both of these accidents can be seen to have led to more efficient use of their time, the result of which was the selection of new e-mail deletion practices.

Participants' patterns of appropriation were typified by both adaptation and inertia (retention). Participants retained similar patterns over time for checking and filing messages, messages sent, inbox size, number of folders, and the type of e-mail management approach adopted (inbox centric, folder centric, or a combination). Furthermore, the large majority of participants perceived their use of e-mail as habitual.

6.7 Summary

Why did users' appropriations of e-mail vary? Variations in patterns of appropriation were influenced by competence, attitudes towards computers in general, age, and a variety of other contextual influences, such as changes in work responsibilities (see Figure 6.7). Both competence and positive attitudes towards computers in general were also found to increase with greater years of use. Patterns of appropriation included adaptations and stabilisations. Users adapted e-mail, associated practices, or both over time. Furthermore, the extent of these changes was substantial for many of the participants. However, some patterns were generally quite stable over time, particularly those associated with e-mail management, the number of messages sent on average each day, filing frequency and the frequency with which e-mails were checked.

An enhanced understanding of the process of appropriation was provided by examining the results from the perspective of each of the four generative mechanisms:

- Lifecycle: Users' patterns of appropriation included both adaptations and stabilisations, even though e-mail was thoroughly incorporated with practices.
- Teleology: A multilevel view of intentionality assisted in providing a richer assessment of the rationale for changes in users' patterns of appropriation. Established belief and attitudinal measures did not significantly influence users' appropriations, perhaps in part due to the lack of intentionality associated with various routinised patterns of appropriations. Nevertheless, many of the changes in patterns were intentional and were explained by reference to a variety of context specific influences.
- Dialectics: Ambivalence was an important emotional synthesis that emerged from the tensions between the affordances and constraints of e-mail. E-mail formed part of users' portfolios of communications channels and associated technologies that also included phone, face-to-face and a variety of other channels. These channels and technologies were synthesised by users to create their portfolios. The process of synthesising new technologies into users' portfolios was also accompanied by substitutions of affordances from the old onto the new.
- Evolution: Accidents and incidents served as important influences on changes to patterns of appropriation for some users. Furthermore, the translation of the accidents into the selection of alternative appropriations was facilitated by the unintended efficiency gains derived from the accidents.

Chapter 7: An enhanced MTA for organisations

7.1 Introduction

This research investigates why users' appropriations of IT artefacts vary. This was achieved through identifying influences on and patterns of appropriation in particular organisational contexts in Defence, and by drawing on the theoretical insights provided by the MTA and four generative mechanisms. In this chapter, the three cases are brought together in order to examine the appropriation of IT artefacts in organisations throughout the technology lifecycle. Because the cases map across the entire lifecycle it is possible to examine influences on and patterns of appropriations that are consistent across phases and those that might be specific to a particular phase. Furthermore, the longitudinal data in each case enables examination of changes in influences and patterns over time. The research questions addressed by these three cases are:

- Why do user's appropriations of IT artefacts vary?
    - What are the influences on appropriation in particular organisational contexts?
    - What are the patterns of appropriation in particular organisational contexts?
    - How effective is the MTA in building understanding of variations in users' appropriations in organisations?
    - In what ways can the explanatory power of the MTA be improved?

The chapter begins with a brief overview of the similarities and differences between the EDMS, AKD prototype and e-mail cases. A cross-case analysis of the qualitative and quantitative data is then presented. The findings are used to contextualise the MTA for the three cases, as well as supporting an argument to include prior appropriations and technology portfolios in the model. An enhanced MTA that is potentially applicable to organisations is then proposed by addressing issues raised about the MTA in this research, and by drawing on the generative mechanisms. The emphasis in this chapter is on description, with implications considered in the next chapter.

7.2 Similarities and differences between cases

The three cases share similarities and differences with respect to the nature of the IT artefacts, the practices with which they are associated and the organisational contexts. These similarities and differences are summarised in Table 7.1 below.

Cross-case similarities	Case specific features
All three	
IT artefacts that support Information/document management and retrieval	
Defence organisations	
Non-discretionary use contexts	
EDMS & AKD	**Versus E-mail**
COTS and bespoke components	COTS only
Non-relational (document centred)	Communications tool
Immature technologies	Mature technology
Pilot implementation (localised)	Pervasive throughout organisation
Document repositories corporately sanctioned	Localised document repositories (individuals inboxes and folders)
EDMS & E-mail	**Versus AKD prototype**
Proprietary software	Open-source software (prototype portal)
Used in workplace multiple times per day	Not available in workplace
Developed by external developers	In-house development of bespoke component (prototype portal)
AKD prototype and E-mail	**Versus EDMS**
Overseas software (UK and US)	Australian software
Captive use	Mandated use
No training	Mandated training

Table 7.1 Cross-case similarities and case specific features

The IT artefacts in all cases provided functionality to support users' information management and retrieval practices. The organisational contexts all shared the feature of being embedded within Defence and involved non-discretionary use. E-mail diverged from the other two systems by being a tool that supported communication, which was a mature technology that was pervasive throughout the organisation and which involved the localised storage of information within users' inboxes and folders. The AKD prototype was distinct due to the in-house development of the prototype portal component using open-source software, and due to not being available in the workplace. EDMS differed from the other two cases since its use was explicitly mandated, as was the training.

7.3 Cross-case analysis

For the cross-case analysis, the qualitative and quantitative findings from each case were mapped using a concept mapping tool (ConceptDraw). All of the maps employed the following first order categories:

- influences on appropriation,
- patterns of appropriation,

- influences over time, and
- patterns over time.

These maps were then combined so as to identify influences and patterns in common across the three cases, as well as those unique to a particular case (see Appendix E). The maps were then converted into tabulated findings as presented below. For the quantitative data, the influences and patterns identified were primarily structured around the pre-defined measures used in the questionnaires. Most of these measures were common to two or three of the cases, with a smaller number specific to each case. For the qualitative data, the influences and patterns were structured according to the pre-defined appropriation concepts, the pre-defined questionnaire measures, as well as the emergent themes and issues.

7.3.1 Influences on appropriation

7.3.1.1 Qualitative

There were three themes common to all cases, functionality, usability (GUI, performance, ease of use), and usefulness (see Table 7.2). The functionality offered by all three systems was viewed positively by participants in each case.

Influences	AKD	EDMS	E-mail
All three cases			
Functionality	Pre and initial use: ✓	✓	✓
Usability			
-GUI/Navigation	Pre use: ✓ (but Retina preferred to Portal) Initial use: ✓ Retina; × Portal	×	~
-Performance	Initial use: ✓	×	✓
-Ease of use	Pre and initial use: ✓	×	✓
Usefulness	~ (3 positive)	✓/×	✓/×

✓ = mainly positive; × = mainly negative; ✓/× = mixed; ~ = insufficient data

Table 7.2 Influences on appropriation (qualitative)

Findings for the three components of usability (GUI, performance, ease of use) were much less consistent across the three cases. The usability of EDMS was generally assessed poorly by participants, particularly with respect to its performance. There were also widespread concerns about its ease of use, intuitiveness and system design. The AKD, composed of Retina and the Portal, generated mixed evaluations. Participants raised a number of concerns about the GUI of the prototype portal, such as difficulties differentiating tab buttons. However, participants were largely positive about the Retina interface and its ease of use.

Views about e-mail were quite positive, with participants liking the speed and reliability of message delivery, as well as the ease of use.

Perceptions of usefulness were quite mixed in the EDMS case. Some people saw it as having led to time savings and improved information access, whilst others saw it as more time consuming than previous practices and involving more steps. The e-mail findings were also somewhat mixed. Some participants liked how e-mail afforded them the time to consider, plan and prepare responses, but disliked the difficulties experienced with managing information, and the volume of e-mail. A few participants in the AKD evaluation workshop found the Retina and the Portal components to be useful in supporting the conduct of tasks such as pre-course preparation and preparing briefs.

7.3.1.2 Quantitative

Measures to assess influences on appropriation are summarised in Table 7.3 and Table 7.4, together with the findings. A review of the descriptive statistics in Table 7.3 shows that the AKD prototype and E-mail were viewed positively by the majority of respondents on most of the measures. This was also the finding for the follow-up phase of the EDMS case. Participants in the initial phase of the EDMS case were mixed in their views about the system: they acknowledged the value of the functionality provided, but had concerns about system design, perceived usefulness, ease of use and usability.

Influences	AKD	EDMS	E-mail
All three cases			
Attitude toward computers	✓ (73%)	I: ✓ (87%); FU: ✓ (91)	✓ (94%)
Usability GUI, navigation, performance	✓ (93)	I: ✓/× (45,49) FU: ✓ (65)	✓ (94)
Ease of use	✓ (93)	I: × (49) FU: ✓ (58)	✓ (81)
System design	✓ (93)	I: × (55) FU: ✓ (68)	✓ (88)
Perceived usefulness	✓ (87)	I: ✓/× (40,56) FU: ✓ (59)	✓ (81)
Competence	✓ (73)	I: ✓/× (51,38) FU: ✓ (63)	✓ (88)
Demands on users	✓ (80%)	I: ✓/× (51,42)	✓ (81)
EDMS and AKD			
Functionality	✓ (100)	I: ✓ (65) FU: ✓ (90)	n/a
Future expectations (org)	✓ (100)	I: ✓ (60)	n/a

✓ = mainly positive (%>3); × = mainly negative (%<3); ✓/× = mixed; n/a = not assessed
I = initial phase; FU = follow-up phase

Table 7.3 Influences on appropriation (quantitative)

The inferential statistics summarised in Table 7.4 identified influences that were significantly related to one or more measures of appropriation. None of the influences were found to be significantly related across all three cases. The EDMS and AKD cases had a number of common influences that had significant relationships with measures of appropriation: usability, system design, perceived usefulness, improvements in tasks/functions and future expectations. Competence was the only influence with a significant relationship in common between the EDMS and e-mail cases.

Influences	AKD	EDMS	E-mail
All three cases			
Attitude toward computers	~	~	E-mail experience
Competence	~	I and FU: use	Nature of use
Usability			~
GUI, navigation, performance	Information quality; Intention to use	FU: use	
Ease of use	~	FU: use	~
System design	Intention to use	I and FU: use	~
Perceived usefulness	Information quality; Intention to use	I and FU: use	~
Demands on users	~	~	~
EDMS and AKD			
Functionality	Information quality; Intention to use	I and FU: use	n/a
Future expectations (org)	Information quality; Intention to use	I: use	n/a

~ = no significant correlations; I = initial phase; FU = follow-up phase

Table 7.4 Significant influences on appropriation (quantitative)

7.3.2 Patterns of appropriation

7.3.2.1 Qualitative

To aid in presenting the combined qualitative findings for patterns of appropriation, the phases of the lifecycle of IT use were employed: pre and initial use for the AKD, pre-use and continued use for EDMS; and continued use for e-mail (see Table 7.5).

The workshop during which the AKD prototype was evaluated explicitly included an evaluation activity prior to use of the prototype. Participants provided their initial impressions of the AKD, as well as ranking and evaluating the prototype components (Retina and the Portal) alongside other knowledge management systems. Participants had a preference for Retina over all other interfaces. After an initial period of use a variety of adaptations were noted. A few people personalised the prototype portal by adjusting the colour scheme and size of frames. Differences were observed in the applications and features used, for example nine people chose to use Retina in preference to the prototype portal, one person used both, and two preferred the portal.[33] There were also adaptations to practices based on system performance differences with some participants conducting multiple searches in parallel when

[33] Attributions of application use were only able to be determined for 12 of 15 participants in the two-day workshops.

using ADEL. In addition, participants all clearly articulated an intention to employ the AKD if given the opportunity in the future. Furthermore, half of the participants who provided written comments (7/14) were positive about the quality of information provided by the AKD.

Phase of use	AKD	EDMS	E-mail
Pre-use:	Preference for Retina over other interfaces	Executive staff not using EDMS	
Initial use	Adaptation of practices based on system performance differences Differences in components and features used Adjustments to colour scheme and frame sizes Intentions ✓ Information quality ✓		
Continued use		Minimal use/ workarounds	Screen configurations: All but 1 person had made changes to default settings
		Core features not used (e-mail transfer function)	Daily rhythms of use, whole or part: receipt (18); set times (13); sporadic (7)
		Misuse of system	Inbox/folder ratio: Inbox centric (7), folder centric (4), combo (12)
		Development of automated publishing capability Still in use and corporately supported	
		User acceptance and dependence	

Table 7.5 Patterns of appropriation (qualitative)

In the EDMS case, the executive personnel in one location were not using EDMS at all. However, most users had little discretion over use since it was mandated. Nevertheless, minimal use of the system was reported, with users endeavouring to work around the system. In addition, core features of the system were not used by many users, particularly the e-mail transfer function. User acceptance and organisational dependence on EDMS was reported in the follow-up phases.

Patterns of e-mail appropriation were assessed in a number of different ways in the e-mail case. Behaviours were assessed by examining how people had configured their screens, their daily rhythms of use, and the emphasis placed on use of the inbox or folders to support storage and management of messages (represented as an inbox/folder ratio). All but one

person had made changes to the default screen configuration settings, such as turning off the reading pane. Daily rhythms of use were wholly or in part driven by message receipt (18), occurred at set times (13), or sporadically throughout the day (7). Three qualitatively different patterns were identified based on the inbox/folder ratio: inbox centric (7), folder centric (4), or a combination of both (12).

7.3.2.2 Quantitative

A range of quantitative survey-based and observational measures were employed to assess patterns of appropriation in each of the three cases (see Table 7.6). Length of use was measured in months for EDMS, years for e-mail and hours for the AKD, reflecting the mapping of each case onto the use lifecycle. In the AKD case, workshop participants had not previously been exposed to the system. A measure of behavioural intention was therefore drawn upon to assess possible appropriation choices in the future. Almost all of the workshop participants expressed an intention to use the system to support their information access and learning needs in the future. The extent of use of the systems was at least once a day or more on average in each case. However, the scripted nature of the AKD evaluation workshops meant that this measure was not meaningful in this case.

Measures	AKD	EDMS	E-mail
All three cases			
Length of use	First exposure during workshop	1 to 16 months (m=6)	4 to 28 years (m=15)
Extent of use	n/a – Scripted use (several times per day during workshops)	On average, once a day or more	All check e-mails several times per day Messages sent: 3 to 80 per day (21)
EDMS and E-mail			
More fine-grained measures of use	n/a	Variation in no. and extent of document types stored/managed (less so for MS Word) Variation in no. and extent of activities supported (less so for search and doc. creation)	Received: 3 to 30 (9) Inbox: 13 to 11014 (1812) Folders: 0 to 320 (88) Filing: 0 to several times per day (m=a few times a week or more)
AKD and E-mail			
Nature of IS use	✓/× (33%, 33%)	n/a	× (69%) = conservative

✓ = mainly positive (%>3); × = mainly negative (%<3); ✓/× = mixed; n/a = not assessed

Table 7.6 Patterns of appropriation (quantitative)

More fine-grained measures of use were employed in both the EDMS and e-mail cases. These revealed heterogeneous patterns of appropriation. With the EDMS case there was considerable variability in the number and extent of document types (MS Word, Excel, PowerPoint and e-mails) stored and managed using EDMS. The only exception to this was some homogeneity in the case of storing and managing MS Word documents, with half of respondents using EDMS several times per day for this purpose. There was also substantial variability in the number and extent of activities supported using EDMS (create documents, collaborative document development, access e-mails of others, search for documents, use of correspondence reference numbers). There was however more consistency in the use of EDMS to support document search and creation, with just under half of respondents employing EDMS several times per day to undertake these activities. With e-mail, there was little consistency across individuals in the number of messages sent and received, the number of messages in the inbox, the number of folders, or the frequency of filing.

The nature of IS use, which is the tendency to use a system differently than others, was employed as a measure in the AKD and e-mail cases. A majority of users did not view their use of e-mail as being different from others, however the results were somewhat equivocal for the AKD case.

7.3.3 Influences and patterns of appropriation over time

7.3.3.1 Changes in influences over time

A. Qualitative

There were data to support an analysis of changes in influences on appropriation over time for the EDMS and AKD cases. In both cases, usability and functionality issues were raised over time, as was usefulness for the EDMS case. However, there were also some changes in the prominence and presence of particular influences. With EDMS, usefulness and functionality were more prominent themes for the initial phase than for the follow-up phase. In the AKD case, comments about performance and usefulness only surfaced after participants began to use the system. Contextual influences, or discrepant events, were important in explaining adaptations to technology or practices in the e-mail case. Influences included changes in work responsibilities or the nature of work, or reflection on practices. Contextual influences were also found in the EDMS and AKD cases although categorised as other influences, for example, the loss of documents leading to users minimising their use of EDMS (usability), or ADEL being less efficient and responsive than the AKD (usability).

B. Quantitative

Influences on appropriation over time were assessed via rating scale measures in both the EDMS and e-mail cases (refer Table 7.7). The effect of time was investigated either by comparing results at two time points (EDMS) or by using the length of use/years of use measure to undertake a cross-sectional analysis (EDMS and e-mail). There was much less evidence of significant changes in influences over time in the e-mail case compared with the EDMS case. Of the eight measures in common, only attitude toward computers in general and competence were significantly different over time for e-mail. By contrast, all but demands on users were significantly different for EDMS.

Influences	**EDMS**	**E-mail**
Attitude toward computers	I vs FU: ↑	Years of use ↑
Competence	FU: Length of use ↑	Years of use ↑
Usability	I vs FU: ↑	~
Ease of use	I vs FU: ↑	~
System design	I: Length of use ↑; I vs FU: ↑	~
Perceived usefulness	I: Length of use ↑; I vs FU: ↑	~
Demands on users	~	~

~ = no significant correlations; I = initial phase; FU = follow-up phase

Table 7.7 Significant influences over time (quantitative)

7.3.3.2 Changes in patterns of appropriation over time

A. Qualitative

Only the e-mail case had qualitative data to support analysis of appropriation patterns over time. All 16 of the people assessed at two time points for the e-mail case demonstrated changes in the extent of appropriations, as well as adapting the e-mail artefact, associated practices or both.

B. Quantitative

Patterns of appropriation over time were assessed via quantitative measures in all three cases, as well as ranking data in the AKD case. Frequency of use was assessed over time for the EDMS and e-mail cases, with users' preferences and intentions assessed in the AKD case. There was increased use frequency with time for EDMS. Furthermore, there were a higher

number and extent of activities supported and documents stored with greater length of use. In the e-mail case, the number of messages sent was quite consistent over time. There was no consistent trend up or down in messages received. However, the nature of participants' use of e-mail tended to be less conservative with greater years of use. For the AKD, initial preferences (rankings) with respect to Retina and the prototype portal were consistent with later assessments of users' intentions to employ the AKD in the future.

7.4 The MTA contextualised for the three cases

The MTA was contextualised to capture the findings from the three cases (see Figure 7.1). The mapping of cases onto the phases of appropriation and the IT use lifecycle was as follows:

- initial exposure (pre-use) - the AKD (A) and EDMS (B),
- initial exposure (initial use) - the AKD only, and
- adaptation and stabilisation phases (continued use) - EDMS and e-mail (C).

Individuals' decisions to adopt EDMS or e-mail were not assessed directly, but were inferred by the presence or absence of use. Adoption intentions were examined directly for the AKD. Influences and patterns of appropriation associated with initial exposure are presented on the left side of Figure 7.1. Influences and patterns linked with continued use are presented top right. Correlation analyses were used in all three cases to identify statistically significant relationships between influences and measures of appropriation. During continued use, for example, competence was related to various measures assessing the extent of use (3) in the EDMS case (B). Competence was also related to the nature of IS use (4) in the e-mail case (C). Changes in influences and patterns over time were also determined via the length of use measure and through comparing data from two or more time points. Significant increases are denoted by '↑'.[34] For example, attitudes towards computers in general were increasingly positive over time in both the EDMS and e-mail cases (↑B&C).

An additional element incorporated into this contextualised MTA was the categorisation of patterns of appropriation according to key concepts, highlighted in **blue**. Abstracting the patterns of appropriation in this way enabled comparison of findings across cases. The emphasis here is on description, with implications considered in the next chapter.

[34] No significant decreases were observed.

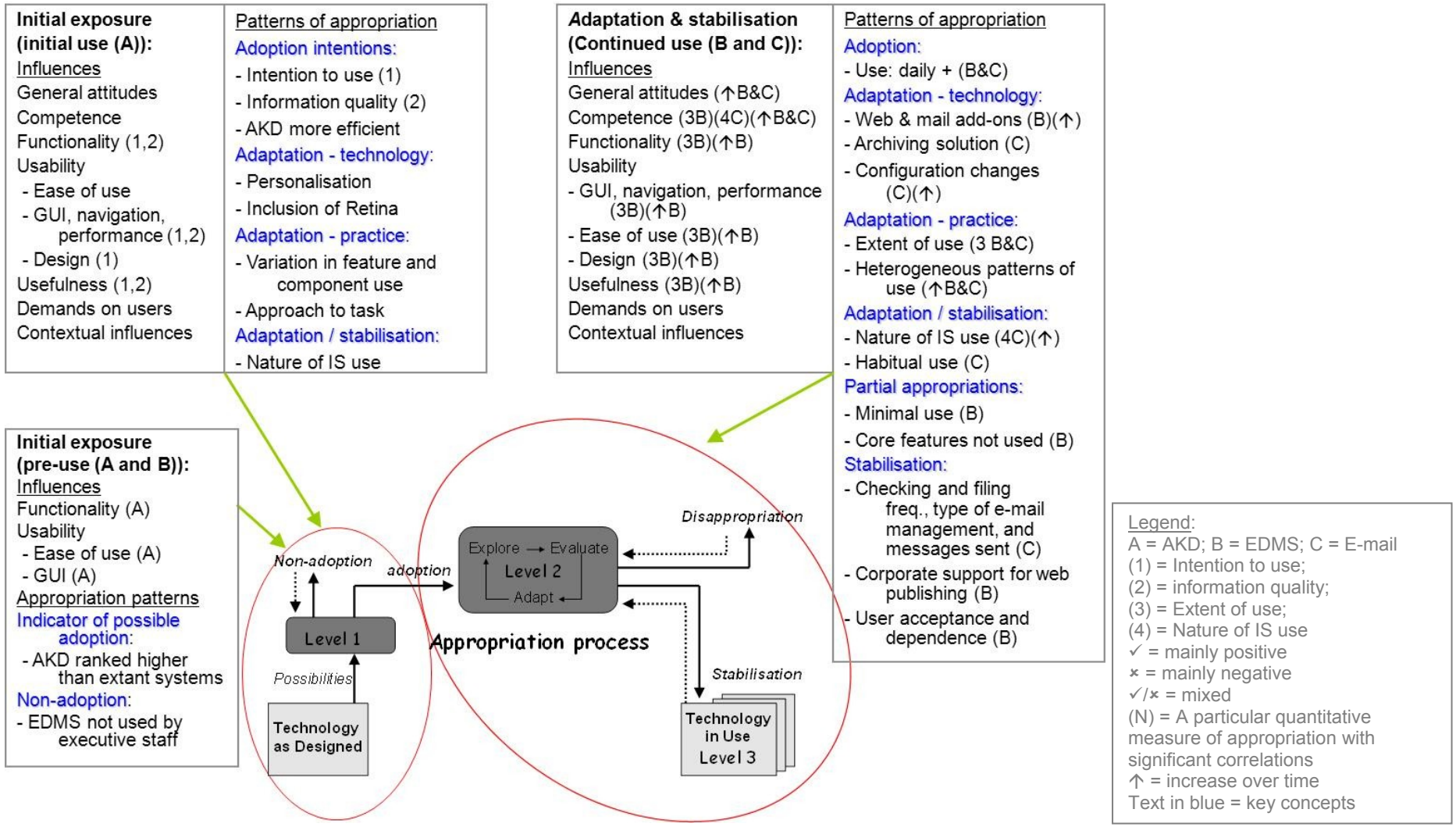


Figure 7.1 The MTA contextualised for the three cases

7.4.1 Influences on appropriation: initial exposure to stabilisation

For the pre-use sub-phase, functionality and usability were prominent influences (see Figure 7.1).

Combining the qualitative and quantitative findings led to the identification of a subset of variables and themes that were consistently identified as important influences for initial and continued use: attitudes towards computers in general, competence in using the particular artefact, system functionality, usability (perceived ease of use, design, GUI, navigation, performance), perceived usefulness and demands on users (see Figure 7.1). Importance was judged either by the emergence of the theme in the qualitative analysis or by a majority holding positive or negative views about the issue based on quantitative or qualitative data. A review of significant influences on measures of appropriation, derived from the quantitative data (denoted by '(N)') identified functionality, usability and usefulness across initial and continued use. However, none of these influences were significant for the e-mail case (C). Therefore, none of the influences were significantly related with appropriation measures across all three cases.

The identification of influences on users' adaptations and stabilisations required evidence of clear links. In the case of adaptation, only those influences significantly related to measures of adaptation, or influences that could clearly be associated with changes in practices or technology parameters (i.e. contextual influences), were included. Measures of adaptation included extent of use, nature of IS use (high ratings), and habitual use (low). Influences on adaptation in the EDMS case, assessed via extent of use (3), included all of those listed for continued use, with the exception of attitudes towards computers and demands on users. In the e-mail case, competence was seen to influence adaptation, as measured by nature of IS use (4). Contextual influences, or discrepant events (Tyre & Orlikowski 1994), also played an important role in shaping adaptations for e-mail users, and to a lesser extent for EDMS users. Stabilisations were identified using the nature of IS use (low) and habitual use (high) measures, as well as through tracking patterns of feature use that were consistent over time. Only one significant link was found, between competence and nature of IS use for the e-mail case.

Evidence of changes in influences over time was found for all three cases. Usability and functionality issues were raised by AKD participants before and after use. However,

comments about performance and usefulness issues only surfaced after use of the system. EDMS users' perceptions of most of the influences assessed were found to be significantly more positive with time (highlighted by the notation '↑B'). In the e-mail case, only attitudes towards computers in general and competence were identified as changing significantly with time.

7.4.2 Patterns of appropriation: initial exposure to stabilisation

The means of assessing patterns of appropriation were quite diverse across the three cases (see Figure 7.1). This limited comparison of findings across cases based on particular measures. To facilitate comparisons, the findings were categorised based on key concepts associated the process of appropriation, highlighted in blue.

The process of appropriation, according to the MTA, begins with initial exposure to a technology. After exposure a decision is made whether or not to adopt the technology. Individuals' decisions to adopt the artefacts were not assessed directly in any of the three cases. However, there was clear evidence of non-adoption in the EDMS case, with executive staff not using the system. There was also an indicator of possible adoption of the AKD prior to use, with it being ranked higher than existing systems. In addition, AKD participants clearly conveyed strong adoption intentions after some use. The decision to adopt EDMS and e-mail was inferred from the daily use of these systems.

The phase following initial exposure entails a period of exploration, evaluation and adaptation during which users adapt the technology, their practices or both. Adaptations to technology were surfaced at an organisational level in all three cases through software add-ons. Individual level adaptations to technology were identified in the e-mail and AKD cases through configuration changes and personalisation respectively. Adaptations to practice were present in all three cases. Common to all cases were variations across individuals or over time in their patterns of feature use, which provide insights into how a technology is being called on to support people's practices. For example, with the introduction of EDMS, HQ personnel were now required to completed meta-data whenever they created a new document.

The MTA posits that over time adaptations cease and patterns of use stabilise, reaching a state of 'technology in use' whereby use of the artefact becomes a taken-for-granted part of the work landscape. The findings from the e-mail case were well suited to identifying

stabilisations. Whilst adaptations were widespread, there was also evidence of certain aspects of e-mail use being stable over time, such as the type of e-mail management approach adopted. There was also some partial evidence of stabilisation with the EDMS. There were reports of widespread dependence and acceptance of EDMS, as well as it becoming part of everyday work life. The propensity of people to adapt or stabilise their use of a technology was inferred from assessing their nature of IS use in both the AKD and e-mail case, and through an assessment of habitual use in the e-mail case. The findings for the AKD were mixed, with a minority of people seeing their use of the AKD as being different (33%) or not different (33%) from others. In the e-mail case, the majority perceived their use as conservative and habitual, although there was evidence that use was less conservative with greater years of use.

An alternative outcome from the adaptation phase is disappropriation, whereby the artefact is rejected by users. There was no evidence of disappropriations with EDMS or e-mail. There was, however, evidence of partial appropriations of EDMS as demonstrated by core features of the system not being used, and users minimising use via workarounds.

With the MTA, patterns of 'technology in use' are also seen to be heterogeneous across individuals. This proposition was strongly supported in all three cases.

7.5 Consideration of context

The MTA emerged out of contextually rich qualitative data, however, it was not constructed to draw attention to the role of context in shaping the process of appropriation. In this research, the process of appropriation was embedded within a context composed of personal, technical and organisational elements (adapted from Linstone (1999)). The personal context was assessed through examining user attributes, such as demographics, their attitudes towards computers in general and competence in using the artefacts of interest. The technical context was assessed in order to provide a means of comparing the artefacts of interest with previous or existing systems with similar functionality. Organisational contexts within Defence were investigated as part of the construction of case descriptions.

Located at the intersection of the personal and technical, two notable and related findings to emerge from the data were the importance of situating users' appropriations of technology in the context of their prior appropriations and their technology portfolios. People's evaluations

of systems are shaped by prior experiences associated with the same or related technologies and practices, here referred to as prior appropriations (Jasperson et al. 2005). Use of a particular artefact is also situated within a portfolio of complementary technologies that are used together to support users' practices (Carroll 2005).

7.5.1 Prior appropriations

Users of EDMS had employed it for between one and 16 months when queried about their perceptions and patterns of use. Users of the AKD were first exposed to the system during the evaluation workshops. In both these cases, perceptions and patterns of use were informed by prior appropriations of similar technologies. Prior appropriations of most relevance to the AKD were those associated with ADEL. The role of ADEL in supporting learning and information search practices of most participants suggested that a tool like the AKD would be employed by the majority of participants if it was deemed more effective. The juxtaposition of ADEL against the AKD, in the context of undertaking learning and information search activities, assisted participants in identifying which system they preferred and why. Participants showed a strong preference for the AKD because it was seen as much more efficient and effective, which suggested that users' would quickly migrate across to it if it were implemented.

For many participants, EDMS was viewed as an unwanted divergence from their normal practices, centred on use of home drives on the network, the mail inbox and folders, as well as paper based files. After being implemented it was utilised by most people, but there was evidence of minimal use, and maintenance of prior appropriations. For example, many officers were reported to have failed to transfer e-mails into EDMS, instead preferring to continue with accessing such material via their e-mail clients. Furthermore, people were still using their home drives or making corrections to paper-based documents, rather than loading documents onto EDMS.

Prior appropriations of e-mail were captured for the 16 people who participated in follow-up interviews. The identification of these prior appropriations made it possible to examine changes in patterns over time. Furthermore, these prior appropriations were also influences on subsequent appropriations, particularly where there was evidence of stability in patterns over time. For example, the number of messages sent was very consistent over time suggesting that previously established patterns for sending messages were an influence on later patterns.

7.5.2 Technology portfolios

The AKD was composed of two components: Retina and the Portal. Despite the marked preference for Retina, there were some people who chose to employ both components in combination, creating a portfolio of complementary technologies. Retina provided them with a means of searching for information they were less sure of, whereas the Portal facilitated structured access to frequently used documents.

One of the benefits of adopting a portfolio view of technology is that it can assist in judging the extent of adaptations to practices associated with the introduction of a new technology. The EDMS case shows this in a compelling way. EDMS was introduced into a context containing pre-existing technologies (paper and network storage (including e-mail inbox/folders)) that supported document management and storage behaviour. An examination of the extent to which users employed paper, network storage or EDMS showed that all participants employed at least two different methods for storing and managing documents, with 27 of 32 employing all three methods (EDMS, network, paper). This suggests that prior practices had to some extent been maintained following the incorporation of EDMS into users' technology portfolios. Nevertheless, the majority of personnel were using EDMS. The introduction of EDMS had forced the adaptation of extant practices. For example, personnel were now required to enter meta-data on creating new documents.

Like the other two cases, e-mail was not used in isolation. Participants identified a number of different technologies and communication channels they employed alongside e-mail to support their communications and information management practices. Prominent amongst these were the phone and face-to-face (FTF). Overall, e-mail was ranked second after FTF, but higher than the phone. Participants also paired these various channels as part of the repertory grid technique. All participants paired phone and e-mail, 15 contrasted e-mail with phone and FTF; and five paired e-mail and FTF.

Adaptations to technology, practices or both were found for all participants in the e-mail case who participated in two interviews. Three people provided reasons for changes in the e-mail appropriations related to the introduction of new ICT into their technology portfolios, in particular, enterprise vault and Skype Instant Messenger, external broadband access, and MS

Communicator. For example, broadband access from home had led to increased checking of e-mail.

7.6 Generative mechanisms

7.6.1 Lifecycle

The MTA describes the process of appropriation by drawing on a range of concepts: non-adoption, adoption, adaptation (technology and/or practices), disappropriation, and stabilisation. All of these concepts, except for disappropriation, were used to describe the findings. These concepts were modified to create additional concepts that supported richer descriptions of appropriation: adoption intentions and partial appropriations. The initial exposure phase of the appropriation process was also modified by sub-dividing into two phases: pre-use and initial use. This sub-division assisted in providing a more nuanced assessment of influences and patterns of appropriation at the initial exposure phase.

The association of the MTA concepts with particular phases of appropriation was called into question by the findings from this research. In particular, adaptations to the artefacts and associated practices were identified during the initial exposure phase, prior to the decision to adopt. The association of 'technology in use' with stabilisation also appears problematic. 'Technology in use' is defined as 'technology as it is currently used' and is clearly linked to stabilisation in the description of the model (Carroll 2004; Carroll et al. 2002b, p.2). The findings from this research showed that 'technology in use' also occurs during adaptation.

The MTA shows multiple 'technologies in use', reflected by the stacked boxes (see Figure 7.1). This means that patterns of appropriation across individuals are expected to vary. There was considerable support for this, with heterogeneous patterns found in all three cases, although for certain features or tasks patterns were more homogeneous.

The MTA describes the appropriation trajectory of an individual up to the point of "technology in use" at which time the model then describes outcomes across multiple individuals. This inconsistency is potentially confusing and could be resolved by representing the trajectories of multiple individuals across the entire model. This would also assist in capturing the heterogeneous patterns of appropriation that were found across the entire process of appropriation.

This research adopted a feature centric approach to understanding system use (Jasperson et al. 2005). What this revealed in the e-mail case was that adaptation and stabilisation can occur concurrently. For example, the frequency of checking messages was quite stable over time, however, people also made configuration changes. However, the MTA implies that there is a transition from adaptation to stabilisation and potentially back to adaptation. The MTA may therefore need to be modified to account more effectively for concurrency.

The MTA was designed to be a generic model that could be contextualised for different systems and user cohorts. Part of the rationale for it being a generic model was the supposition that influences on patterns of appropriation would be unique to particular technologies and cohorts, which therefore precluded the specification of influences as part of the model. The three cases in this study were all within Defence and shared other contextual features in common, such as non-discretionary use. Nevertheless, there were aspects of context that were unique to each case. Furthermore, each case mapped onto different phases of the appropriation process. Despite these differences, there were certain themes from the qualitative analysis that consistently emerged across cases and phases: functionality, usability and usefulness.

Empirical work associated with the development of the MTA has shown that influences on appropriation change over time (Carroll et al. 2002b; Mendoza et al. 2005). Influences can become more or less salient over time, and the influences operating at particular phases may also vary. The findings from this research provide additional evidence of such changes, which lends support to adopting a lifecycle perspective on appropriation.

7.6.2 Teleology

At the core of teleology is the purposeful pursuit of goals by individuals or organisations acting intentionally. Organisational and individual level intentionality was found in all three cases. Organisational decisions to develop a prototype knowledge domain, acquire an electronic document management system, or install an archiving solution were all driven by goals to enhance the management and sharing of information. At an individual level, intentionality also was seen to operate across all three cases, although it was less prominent in the e-mail case perhaps due to some habituation, but also due to limitations of survey-based

methods in identifying context-specific reasons why users decide to change their patterns of appropriations.

The AKD and EDMS were similar in being immature technologies. The users of the AKD and many of the EDMS users were still actively engaged in exploring the technologies. These contextual features meant that the AKD and EDMS cases were particularly well suited to exploring the intentionality of users and influences on their decisions to engage with and adapt the technology. The findings from these two cases reinforced this view, with both having a number of common influences that were related significantly with measures of appropriation.

Two prominent influences considered in the cognitive-rational IS literature are perceived ease of use and perceived usefulness. In this research, ease of use was included under the broader concept of usability. The qualitative and quantitative data from the three cases highlighted the important role played by usability and usefulness in shaping users' intentions and behaviours. However, inferential statistics failed to identify significant relationships across all three cases. With the data from the e-mail case excluded, usability and usefulness were significantly related with one or more measures of appropriation. The specific functionality offered by an artefact was also a significant influence, and also emerged as a prominent theme from the qualitative analysis.

7.6.3 Dialectics

A common tension in all three cases was that between artefacts within users' technology portfolios. The AKD was composed of two artefacts or components (Retina and the Portal). Users were encouraged to explore each component during the workshops. For most users, any tensions created by deciding which system to use were quickly resolved in favour of Retina, although there was also evidence of the Portal being preferred, as well as both being used in combination. So users were initially presented with a portfolio solution, but using the two components in combination did not provide most participants with additional support for their practices leading to selection of a single artefact.

EDMS formed part of a portfolio of technologies that was also composed of network storage (such as e-mail inbox/folders) and paper files. The use of EDMS was mandated, so maintenance of the status quo (network storage and paper files) was not possible for most

users. Instead, EDMS became part of their portfolios associated with document and information management. Nevertheless, the findings suggest that it had not become an integral part of many users' portfolios. Synthesis had occurred to some extent but this appeared to be related more to the addition of new practices prescribed by EDMS than the substitution of pre-existing practices.

E-mail, phone, face to face and a variety of other technologies and channels were drawn on as part of a portfolio to satisfy users diverse communication and information management needs. E-mail therefore had been synthesised with complementary technologies and channels. The ways in which they complemented each other was informed by the affordances and constraints associated with particular components of the portfolio. For example, e-mail was often used for information exchange but tended not to be used when more immediate and subtle communication was required, with phone or face-to-face preferred.

The introduction of Enterprise Vault and MS Communicator presented users with technologies that were the antithesis to the existing portfolio of technologies and practices associated with e-mail (the thesis). Some people embraced these technologies through synthesising them with their extant technology portfolios. Others had engaged in substitution of functions or affordances, such that the allocation of particular technologies to particular practices within their portfolios was adjusted. For example, one person substituted e-mail with MS Communicator for informal communication and coordination amongst a walking group. Most participants maintained practices associated with their extant portfolios. All three possible outcomes of tension between the thesis and antithesis were therefore observed: synthesis, substitution, and maintenance of the status quo.

7.6.4 Evolution

Evolution is typified by processes of variation, selection and retention. Variations were identified in all three cases and included:

- unanticipated problems integrating the Autonomy search engine with the Portal, which was pivotal in the decision to include Retina;
- the loss of documents whilst using EDMS, encouraging some users to minimise their use of the system; and
- a small number of accidents or incidents, such as accidental deletion of e-mails, leading to more efficient patterns of appropriation.

Selection results from competition for scarce resources. In all three cases, time and effort were resources that played an important role in shaping appropriation patterns. The AKD was more efficient that ADEL, which contributed to strong intentions to use it in the future. The experience of losing work via EDMS introduced an additional time impost. EDMS also introduced a requirement to engage in additional practices, such as entry of meta-data. In the interests of minimising the time impost some users therefore engaged in workarounds. E-mail consumes a lot of time and effort. Events that led to time savings with no apparent consequences were therefore selected in preference to previous practices.

Retention counteracts the pressure to change associated with variation and selection. It represents the inertia associated with extant system. Evidence of ADEL being retained in preference to the AKD was not found during the AKD workshops. Inertial forces were readily apparent, however, in both the EDMS and e-mail cases. Users of EDMS involved in the follow-up phase had all maintained at least one other pre-existing technology to support their document management practices. Evidence of stable patterns of use, for such things as frequency of checking and filing, were identified in the e-mail case.

Whilst e-mail and EDMS both manifested all three evolutionary processes, they appear to have exhibited qualitatively different evolutionary dynamics. Users of EDMS showed increased use of the system over time. This was not the case for e-mail, where there was no clear trend up or down across individuals in messages received, and where other patterns, such as messages sent, were quite stable over time. One explanation for this is that users were still exploring EDMS, learning about its capabilities, and gradually expanding the range of document types and activities supported by EDMS. By contrast, e-mail was thoroughly embedded with users' practices, with changes in patterns of appropriation driven more by situational influences.

7.7 An enhanced MTA for organisations

The MTA was selected to examine the lifecycle of IT use because it provides coverage across the entire lifecycle. The model describes the process through which people adopt, adapt and incorporate a technology with their practices (see Figure 7.2). Use of the MTA to explain the findings in this study highlighted ways in which it contributed understanding, but also areas where the model could be enhanced. The model is enhanced through:

- modifying the way technology appropriation is described (Figure 7.3);
- including additional generative mechanisms (Figure 7.4); and
- explicitly representing context (Figure 7.5).

This section presents the changes made to the original MTA to enhance its descriptive and explanatory power. Discussion of these changes occurs in section 8.4.

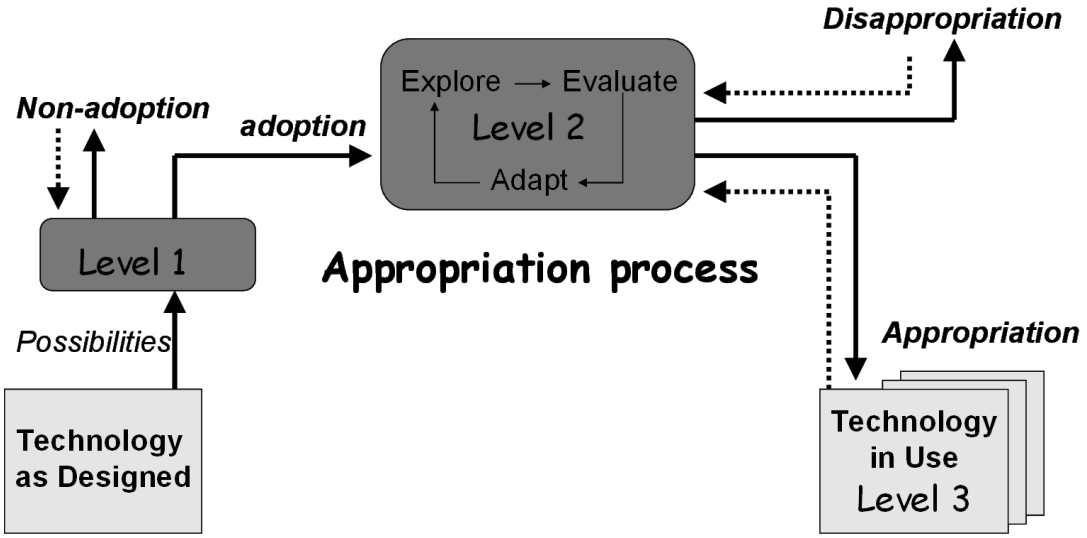


Figure 7.2 The MTA (Carroll 2004, p. 5)

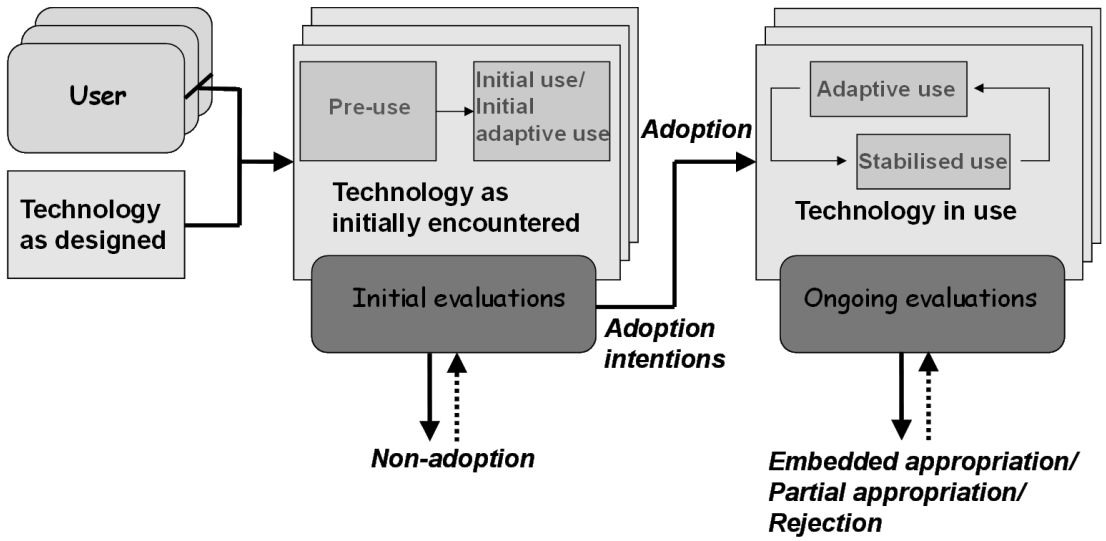


Figure 7.3 An enhanced description of technology appropriation

Description of technology appropriation is enhanced through removing and modifying some features, as well as incorporating new features. Features removed include:

- the 'appropriation process' label.
- the 'explore' sub-element of level 2.

Features modified include:

- the ‘adapt’ sub-element of level 2, which is captured in the ‘initial adaptive use’ and ‘adaptive use’ elements of Figure 7.3.
- appropriation, associated with ‘technology in use’, which is represented as ‘embedded appropriation’.
- disappropriation reframed as rejection.
- levels of evaluation removed and replaced with initial’ and ongoing evaluation. Level 1 evaluation is replaced with initial evaluation. The second and third levels of evaluation are brought together as ‘ongoing evaluations’.
- the initial exposure phase, reframed and explicitly represented in the model as ‘technology as initially encountered’ to be consistent with ‘technology as designed’ and ‘technology in use’.
- the adaptation phase, which is subsumed within the ‘technology as initially encountered’ and ‘technology in use’ phases.
- the incorporation phase, which is replaced with the ‘technology in use’ phase.

Additional features include:

- representation of heterogeneity in patterns of appropriation across individuals not only during ‘technology in use’, but also during initial exposure (denoted by the stacked boxes).
- the user, the link between the user and ‘technology as designed’, and representing the interaction of multiple users with ‘technology as designed’ (denoted by the stacked boxes).
- Dissociation of ‘technology in use’ from stabilised use, through incorporating adaptive use as part of ‘technology in use’.
- the four phases of the IT use lifecycle, with pre-use and initial (adaptive) use associated with the initial encounter phase of the appropriation process and adaptive and stabilised use associated with the ‘technology in use’ phase.
- the distinction between pre-use and initial use during the initial encounter phase.
- initial adaptive use during the initial-use sub-phase.
- partial appropriation as a distinct outcome of the process of appropriation alongside of rejection (formerly disappropriation). Furthermore, the corollary of these two forms of appropriation is embedded appropriation (bottom right).
- adoption intentions as a precursor to the decision to adopt.

- capturing the potential for concurrent adaptation and stabilisation through positioning adaptive use and stabilised use as operating in parallel, not in sequence.

The MTA and the enhanced description of technology appropriation are primarily lifecycle models of change; their explanatory power is therefore constrained. To overcome this constraint, three additional perspectives on change are introduced: teleology, dialectics and evolution. Figure 7.4 adds these theories of change to the enhanced description (Figure 7.3), with each theory contributing to an enhanced explanation of technology appropriation. The four theories are represented by lenses in each corner, with the three additional lenses in bold (see Figure 7.4).

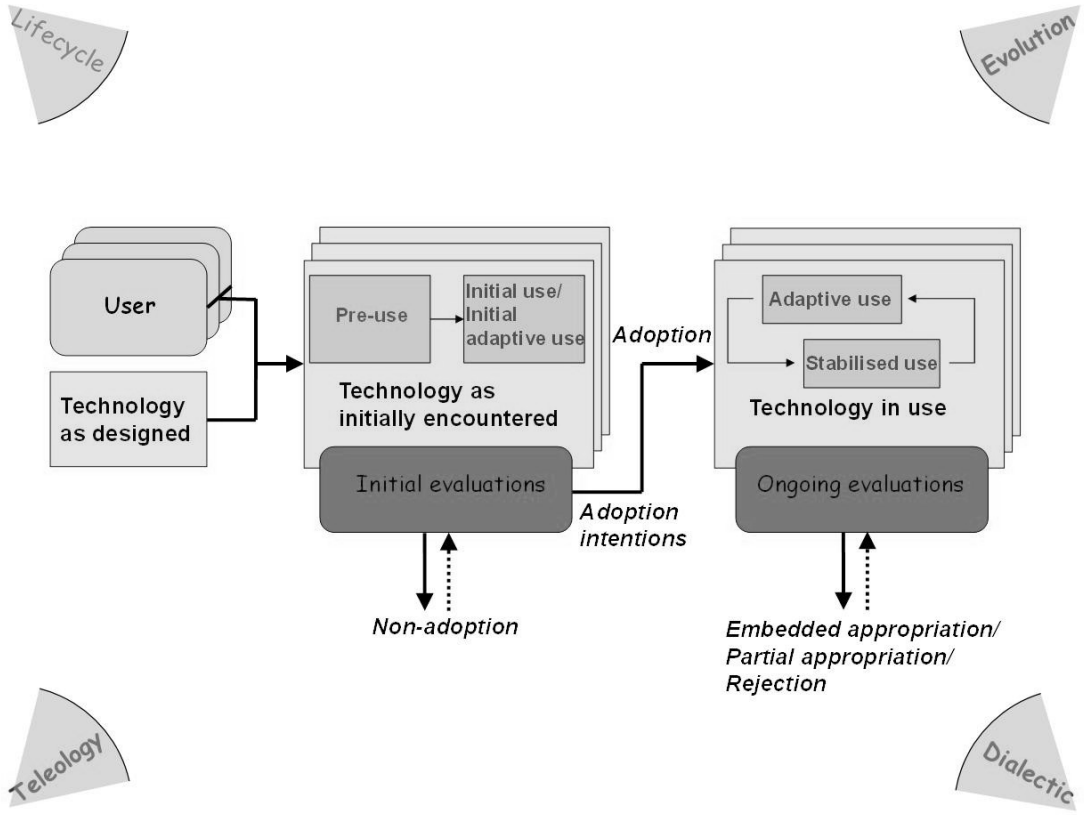


Figure 7.4 An enhanced explanation of technology appropriation

The teleological, dialectic and evolutionary theories of change reinforce elements of technology appropriation already captured to a limited extent by the enhanced description of technology appropriation, as well as introducing new elements that enhance explanation of technology appropriation. The new and reinforced elements are drawn out by situating the enhanced description within a personal, technical and organisational context (see Figure 7.5, two outermost bands of the model).

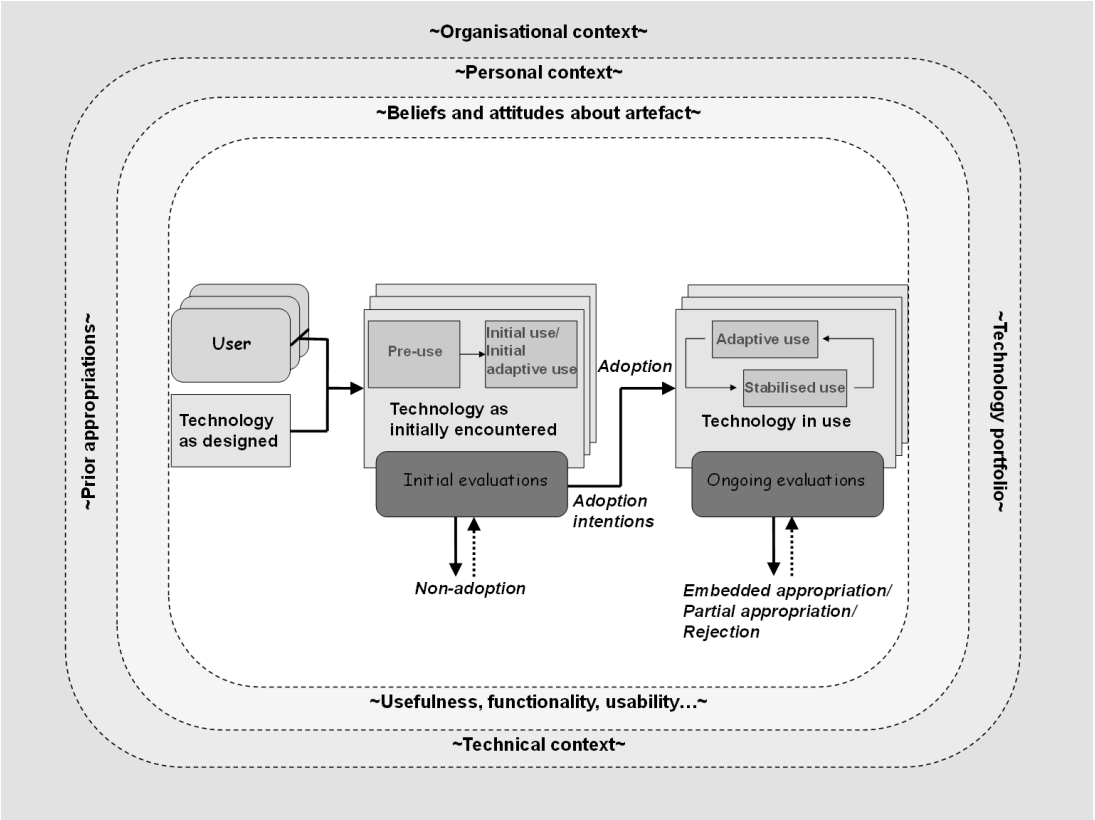


Figure 7.5 An enhanced MTA for organisations

A teleological perspective reinforces the following features of the enhanced description:

- outcomes of users evaluations: non-adoption, adoption intentions, adoption, rejection, partial appropriation and embedded appropriation.
- initial and ongoing evaluation and associated belief and attitudinal influences, such as usefulness, functionality and usability.

This perspective also introduces the organisational context as another source of intentions and actions that shape and influence the appropriations of individuals.

The dialectic perspective is not clearly a feature of the descriptive model (see Figure 7.3). Technology portfolios are an additional element of technology appropriation drawn out by adopting this perspective. Technology portfolios sit at the intersection of the personal and technical contexts where prior appropriations are also located. Prior appropriations are also a feature brought into relief by a dialectic lens. Prior appropriations set the context within which users seek to resolve tensions between extant technologies and a new technology.

An evolutionary viewpoint emphases the role of:

- variations in the environment, represented as the organisational and technical context, in influencing evaluations and patterns of appropriation.
- variations in influencing changes in patterns of appropriation, represented as initial adaptive use and adaptive use.
- Selection pressures, such as the amount of time and effort available to invest in learning about a new technology.
- retention, in particular stabilised use and prior appropriations, in counterbalancing variation and selection.

This perspective also brings into relief the mutual adaptation that occurs between users and a particular technology throughout the process of appropriation, as well as the dynamic nature of context, beliefs, and attitudes (captured by including the '~' symbol either side of these components in Figure 7.5).

Figure 7.5 builds on the previous two figures: it provides an enhanced description of the appropriation process; it conveys the explanatory power provided by additional generative mechanisms; and it explicitly represents context. The outcome from combining these elements is an enhanced MTA for organisations.

The enhanced MTA describes and explains the process of appropriation through which users interact with and evaluate technology over time. The process of appropriation is characterised by movement through two phases: 'technology as initially encountered' and 'technology in use'. When users first encounter a technology they conduct an initial evaluation of how it could support their practices. This evaluation occurs as users start to become acquainted with the technology prior to and during initial use. Users' initial encounters may also entail initial adaptation to the technology. The culmination of this phase is a decision to not adopt the technology, or an intention to adopt. The transition from intention to adoption occurs when users decide to further evaluate the technology in the context of their practices. During this phase of 'technology in use', users adapt the technology, as well as adapting their practices. Over time certain patterns of feature use and associated practices may stabilise. Adaptive and stabilised patterns may also co-exist. Users' ongoing evaluations may result in embedded appropriation, where by the technology is thoroughly incorporated with practices. It becomes a taken for granted part of users' work lives. Conversely, users may only partially appropriate the technology, actively seeking to work-around or minimise their use, or even rejecting the

technology outright. At any time throughout the process of appropriation users may re-evaluate their appropriation decisions or patterns of appropriation (represented by the dashed arrow from non-adoption back to 'initial evaluations', and from the three appropriation outcomes back to 'ongoing evaluations'). A potential user may move from non-adoption to having an intention to adopt, or a person engaged in embedded appropriation may move to partial appropriation or even rejection or vice versa.

The process of appropriation through which users first encounter, evaluate, then bring into use a technology shapes and is shaped by beliefs and attitudes about the technology, as well as the personal, technical and organisational context within which they are embedded. Users evaluate a particular technology with respect to its usefulness, functionality and usability, as well as a variety of other belief and attitudinal influences specific to the particular technology, user cohort and use context (denoted by '…' next to 'usefulness, functionality, usability' in the inner most band of Figure 7.4). Influences on users' evaluations can also be random or accidental events that serve as potential triggers to adapt or change patterns of appropriation. Whether or not such triggers lead to changes is shaped by the amount of time and effort users have to devote to learning about a technology and incorporating it with their practices. It is also counteracted by pressures to maintain inertia or habitual patterns of use associated with prior appropriations.

Users' ongoing 'technology in use' is shaped by prior appropriations of the same technology. Prior patterns of appropriation can become a habitual influence on current patterns of appropriation, leading to stabilised use. Users also appropriate a technology in the context of their prior appropriations of related technologies. The juxtaposition of the old and the new creates tension that needs resolution. This process of resolution occurs in the context of users' technology portfolios. The non-adoption of a technology represents the maintenance of prior appropriations. Adoption and subsequent 'technology in use' represent a synthesis when the affordances of the old and the new are combined, or represent substitution, when the old is replaced by the new.

The process of appropriation also influences and is influenced by the organisational context within which it is situated. The availability of particular technologies, the ways they are configured and managed, and even the discretion to use is often determined by key

stakeholders in an organisational context. The decisions made by these higher-level stakeholders can enable or constrain the choices of users, and create tension.

7.8 Summary

Why do users' appropriations of IT artefacts vary? None of the influences derived from the quantitative survey data were significantly related to measures of appropriation across all three cases. Nevertheless, there were a variety of influences that were particularly salient for individuals across all three cases, most notably usability, usefulness and functionality. Changes in influences over time were found in all cases, although there was no consistency in influences across cases. A variety of qualitatively different patterns of appropriation were found including appropriation intentions, adaptations to technology and practices, partial appropriations and stabilisations. These patterns were largely heterogeneous across individuals. Furthermore, in the two cases where patterns over time were assessed in some detail (EDMS and e-mail) there was evidence of changes in patterns over time.

Considering the cross case findings through the lens of each of the four generative mechanisms enhanced understanding of technology appropriation:

- Lifecycle: The MTA provided a useful foundation to examine the phases of technology appropriation in organisations, however, adjustments were required to better align the model with the findings, such as the incorporation of adaptation as part of 'technology in use'.
- Teleology: Organisational and individual level intentionality was found in all three cases, although individual intentionality was driven more by situational influences in the e-mail case.
- Dialectics: The artefacts of interest in each case were located within technology portfolios. There were tensions between the constituent artefacts of the portfolios leading to maintenance, substitution and synthesis.
- Evolution: Variation, selection and retention processes were identified in all three cases. Variations took the form of unanticipated problems, accidents and incidents. Time and effort were important elements of the selection process. Retention was manifested via the persistence of prior technologies in the AKD and EDMS cases, and via evidence of stability in some patterns of appropriation for e-mail.

In light of the findings, the MTA was enhanced through: modifying how technology appropriation is described; including additional generative mechanisms; and explicitly representing the organisational, technical and personal contexts within which users and the particular IT artefact are embedded.

The next chapter considers how the findings from this research contribute to the body of literature on the lifecycle of IT use and appropriation. The conceptual, theoretical, methodological and practical implications are also examined.

Chapter 8: Conclusion

8.1 Summary of study

This thesis develops understanding of the appropriation of IT artefacts over time. Perceptions that the whole lifecycle of IT use, from pre-use, then initial use through to adaptive and stabilised use is not well understood were evaluated and supported in the initial part of the study. A generic lifecycle model of use, the MTA, was chosen for the study because it covers the entire lifecycle, and it can be contextualised for different technologies, and user cohorts. However, the MTA has two shortcomings: its ability to explain the how and why of the appropriation process; and the limited cumulative tradition, particularly in the organisational domain. The remainder of the study addressed these gaps through investigating the following overarching question and associated research questions:

Why do users' appropriations of IT artefacts vary?

a. What are the influences on appropriation in a particular organisational context?
b. What are the patterns of appropriation in a particular organisational context?
c. How effective is the MTA in building understanding of variations in users' appropriations in organisations?
d. In what ways can the explanatory power of the MTA be improved?

The model was contextualised, tested and extended through data collected from three case studies that provided coverage of the entire lifecycle and involved a prototype information portal, a document management system that had been recently implemented, and an e-mail client. Defence was selected so as to provide an extreme organisational context which manifests strong structural and cultural imperatives to control use. Despite these imperatives, the findings demonstrated changes in users' patterns of appropriations over time and heterogeneous patterns of appropriation across individuals. This indicates that structural and cultural constraints do not necessarily result in uniform or homogeneous use of IT artefacts. In addition, influences on patterns of appropriation differed throughout the lifecycle. The findings were used to contextualise the MTA by including case-specific influences and patterns of appropriation. Contextualisation was followed by a critical evaluation of the fit between the core elements of the model and case findings, where the core elements represent those features of the model that exist prior to contextualisation. Whilst the MTA facilitates understanding of appropriation, the model was enhanced through: modifying core elements of the model; incorporating teleological, dialectic and evolutionary generative mechanisms; and

including contextual features associated with appropriation of the particular IT artefacts studied.

In this chapter, the influences on and patterns of appropriation identified over time are considered in the context of the wider literature. Key concepts for understanding the process of appropriation are described, as well as modifications and additions to the core concepts from the MTA. The value of going beyond the use concept to employ appropriation is also examined. Attention then turns to critically evaluating the utility of the MTA to understand the IT use lifecycle in organisations, as well as the changes made to how the process of appropriation is modelled and described. The value of incorporating a wider view of context and additional generative mechanisms to create an enhanced MTA for organisations is considered. The implications of the study methodology for examining technology appropriation are examined. Practical implications, a critique of the study and future research are outlined.

8.2 The lifecycle examined: influences and patterns of appropriation over time

8.2.1 Influences on appropriation across phases

In Chapter 2, studies that investigated influences operating at each of the phases of the lifecycle of IT use were examined. In this research, all of the phases were examined and will now be compared and contrasted with prior research in order to address the first two research questions (see Table 8.1):

a. What are the influences on appropriation in a particular organisational context?
b. What are the patterns of appropriation in a particular organisational context?

	Prior research	Current study
Pre-use (A,B)	Perceived usefulness Subjective norms	No No
		Functionality (A) Usability (A) Prior appropriations (A&B)
Initial use (A)	Perceived usefulness System adaptability	Yes (1&2: A) No
		Functionality (1&2: A) Usability (1&2: A) General attitudes (A) Competence (A) Demands on users (A) Prior appropriations (A)
Continued use (B,C)	Perceived usefulness Facilitating conditions Usability (inc. ease of use) Behavioural intentions Prior experience Subjective norms	Yes (3B)(↑B)(C) Yes (3B) Yes (3B)(↑B)(C) n/a Yes (B&C – prior appropriations) Yes (C – social norms)
		General attitudes (↑B&C) Competence (3B)(↑B&C) Functionality (3B)(↑B)(C) Demands on users (B,C)
Adaptive use (B,C)	Perceived usefulness System adaptability Discrepant events Misalignments	Yes (3B)(↑B) No Yes (B and C – Contextual influences) Yes (B – *functionality, facilitating conditions, usefulness*)
		Competence (3B)(4C)(↑B&C) Functionality (3B)(↑B) Usability (3B)(↑B) Facilitating conditions (3B)
Stabilised use (B,C)	Perceived usefulness Ease of use Past-use Habitual behaviours	No No Yes (C – prior appropriations) Yes (C, with messages sent)
		Competence (4C)

A = AKD; B = EDMS; C = E-mail; ↑ = increase over time; (↑); (N) = A particular quantitative measure of appropriation with significant correlations: (1) = intention to use; (2) = Information quality; (3) = Extent of use; (4) = Nature of IS use.

Table 8.1 Influences on technology appropriation by lifecycle phase

The enhanced MTA for organisation places pre-use and initial use during the initial encounter phase of technology appropriation. As can be seen in Table 8.1, prior research on pre-use influences found that perceived usefulness (including relative advantage and expectations of positive outcomes) and subjective norms (including normative pressures) are important positive influence on future use intentions (e.g. Mendoza et al. 2005; Taylor & Todd 1995a)(see Appendix A for a summary of the studies that have investigated influences on technology use for each of the phases). Neither of these themes was found in this research. Instead, functionality and usability were clear influences on users' intentions to adopt the AKD. It is unclear why usefulness did not emerge as an influence during pre-use. However,

the absence of subjective norms as an influence can be explained by search being the primary function provided by the AKD, where search is an activity that users tend to undertake as individuals relatively free of normative pressures. This suggests that the type of technology affects pre-use influences. Prior appropriations of similar technologies and practices also played a role in shaping patterns of appropriation. For example, maintenance of prior practices with respect to document management meant that EDMS was not adopted by the executive personnel in one of the HQs (see section 7.5.1).

Usefulness did emerge as a significant influence on future use intentions once users' started to employ the AKD during the workshops; a finding consistent with prior research (e.g. Davis 1989; Davis et al. 1989; Venkatesh et al. 2003). However, perceptions of system adaptability did not emerge as an influence. Perhaps this was due to the nature of the artefact assessed at the pre-use phase, the AKD prototype. The primary function of the AKD was search. By contrast, prior research involved WAP enabled mobile phones (Carroll et al. 2003a) or bibliographic software (Mendoza et al. 2005) both of which involved a wider range of functions and associated features, therefore affording greater opportunities for diverse patterns of use to emerge and for practices to be changed. Additionally, unlike use of search tools, mobile phone use amongst young people is strongly socially situated with an associated desire to express individuality through personalising the phone cover or ring tones (Carroll et al. 2003a). The systems therefore had greater malleability or tailorability than the AKD (Kallinikos 2002; MacLean et al. 1990; Wulf et al. 2005). The type of technology again appears to affect the influences that are manifested.

Functionality[35] and usability were again influences on appropriation for the AKD at the initial use phase. In addition, attitudes toward computers in general, competence, and demands placed on users by the AKD were also rated positively by the majority, suggesting that they played a role in shaping users' appropriations. Such skewed findings are potentially problematic for researchers focussed on only using inferential statistics, because they can undermine the capacity to identify statistically significant relationships. However, the absence of statistical significance does not mean that the finding is not meaningful or useful. The clustering of responses toward one end of a rating scale enhances the capacity to make claims

[35] Functionality is conceptually related to usefulness, since it is via one or more functions that a system delivers efficiency or effectiveness dividends for users. However, they are distinct in the sense that functionality is centred on what the technology can do, whereas usefulness is focussed on the job impacts associated with use of the technology. Furthermore, some functions will have no clear link to job impacts, such as the ability to change the colour scheme of the AKD interface.

about the valence of perceptions about technology held by a particular group. Such skewed views in turn set the conditions within which appropriation choices are made, although the strength of any claims are weaker than can be achieved via statistical inference. Prior appropriations were also an influence on appropriations, with participants able to juxtapose the use of the current system (ADEL) with the prototype system (the AKD) during the workshops. Positive perceptions of the AKD were shaped by users' prior appropriations or experiences of ADEL, compared to which it was seen as more efficient and effective.

All of the influences identified at the initial use phase in the current study were also found at the continued use phase. Additionally, facilitating conditions (EDMS) and social norms (E-mail) emerged as important influences. Facilitating conditions included training and system support, procedures and guidelines, and the management of change. Social norms were the rules developed by e-mail users that represented their beliefs and attitudes about how others should or should not behave, for example, that others should not send spam messages. Five of the six prominent influences found in previous research were also found to be important influences in the current study: usefulness, usability, facilitating conditions, prior experience and subjective norms (e.g. Al-Gahtani & King 1999; Clegg et al. 1997; Igbaria 1990; Igbaria & Tan 1997; Taylor & Todd 1995b). However, prior computer experience and prior appropriations are only somewhat related conceptually. Prior computer experience captures the extent of experience users have with generic types of computer software (Igbaria et al. 1995). Prior appropriations also include the idea of experience, but not in a generic sense. Instead prior appropriations are related to the user's experience with the same or similar technologies in a particular use context. Unlike prior computer experience, the concept of prior appropriations also includes the notion of patterns of use situated in particular use contexts. The sixth prominent influence from prior research was behavioural intentions, which was only assessed at the initial use phase in the current study.

A common measure used to assess initial and continued use is the extent of use. However, use of this measure need not be limited to investigating these phases. It can also be used to identify influences on adaptive and stabilised use. For example, someone who uses EDMS more is likely to have made greater changes to their document and information management practices than someone who uses it in a limited way. Also, even limited use of a new system entails potential changes to practices, such as the requirement to enter meta-data when creating new documents following the introduction of EDMS. Adaptive and stabilised use can

also be identified by tracking the extent of use of a system or system features over time, with no or limited changes indicating stability, and changes indicating adaptation.

Prior research has found perceived usefulness, system adaptability, discrepant events and misalignments as influences on adaptation (Carroll et al. 2003a; Desouza et al. 2007; Jain & Kanungo 2005; Leonard-Barton 1988; Majchrzak et al. 2000; Mendoza et al. 2005; Orlikowski 1992; Orlikowski 2000; Tyre & Orlikowski 1994). The current study assessed adaptation via the extent of use, nature of IS use and habitual use. Perceived usefulness was found to be a significant influence on adaptation for EDMS. Unlike prior research, competence, functionality, usability and facilitating conditions were also significantly related to the extent of use for EDMS. The lack of correspondence with prior studies on adaptive use may be due to these studies not often measuring the extent of use, nor identifying influences on the extent of use. In the e-mail case, none of the influences were significantly related to the extent of use, however, competence was positively related to the nature of IS use. Finding only one significant relationship for e-mail could be due to users' appropriations often not being goal directed but determined by habitual routines or by contextual influences.

System adaptability did not emerge as an influence in the current study. System adaptability represents users' perceptions of the extent to which they can modify an IT artefact. The absence of this influence is therefore initially puzzling at the adaptive use phase. However, in the case of EDMS, the opportunity for people to explore the capabilities of the system was limited due to the time poor nature of the work context. Furthermore, the configuration management of systems was such that the ability to modify IT artefacts was constrained. These constraints may account for why this influence did not emerge. It is also noteworthy that none of the individual level adaptations associated with EDMS entailed modifications to the artefact. System adaptability may have failed to surface as an important influence in the e-mail case due to the many years of system exposure for participants, combined with the thorough embedding of e-mail with business practices. These circumstances may in turn have diminished the propensity of users to think about and be influenced by the adaptability or tailorability of the system.

Discrepant events were influences in all cases. Discrepant events serve as contextual triggers that encourage adaptation (Tyre & Orlikowski 1994), such as loss of documents leading to a reduction in use of EDMS, or a reduction in the use of e-mail for short messages due to the

introduction of instant messaging. Discrepant events, or contextual influences, were particularly salient influences in the e-mail case, where they accounted for much of users' adaptations to technology and practices.

The concept of misalignments is similarly situated in context (Leonard-Barton 1988). Misalignments occur between technology and: "(a) technical requirements, (b) the system through which the technology is delivered to users, or (c) user organization performance" (p. 252). Three influences considered above that map onto each of these misalignments are functionality, facilitating conditions and usefulness. Investigating perceptions of functionality in the current study involved the identification of artefact specific functions, which can also be framed as technical requirements (the first type of misalignment). Delivery system misalignments occur between the technology and the organisational infrastructure, which includes hardware, software, training and so on. Facilitating conditions form part of the organisational infrastructure. The third misalignment occurs between technology and job performance criteria including the expected impact or usefulness of the technology for work activities. The measurement of perceived usefulness provided a means of investigating this misalignment.

Influences on stabilised use identified in prior research include perceived usefulness, ease of use, past-use and habitual behaviours (Kim et al. 2005; Mendoza et al. 2005, 2008; Tyre & Orlikowski 1994). The current study did not identify either usefulness or ease of use as significant predictors of stabilised use in the e-mail case, where it was measured via nature of IS use and habitual use. Only competence was significantly related to nature of IS use. However, the current study followed prior research in finding past-use and habitual behaviours to be important influences on stabilised use. Past use relates to prior use of the IT artefact under investigation (Kim et al. 2005). Similarly, prior appropriations of e-mail related to prior patterns of e-mail use. Habitual behaviours were measured via a scale developed by Limayem and Hirt (2003), and were found to be significantly related to the number of messages sent. This findings was consistent with an analysis of patterns over time which also showed the number of messages sent was quite stable over time. These results indicate that traditional belief and attitudinal influences on use are not important determinants of stabilised use. This result reflects the lack of intentionality associated with stabilised use, with prior behaviour (past use, habitual behaviours) serving as a better indicator of current behaviour for

this phase (Janis & Nock 2008; Jasperson et al. 2005; Kim et al. 2005; Ouellette & Wood 1998; Webb & Sheeran 2006).

8.2.2 Changes in influences over time

Changes in influences can be understood in two ways: variations in the particular influences that are manifested at different phases, or variation in the valence or strength of beliefs or attitudes over time. Prior research has primarily dealt with the former, with influences found to change over time. For example, discrepant events influence adaptive use and past use influences stabilised use (Kim et al. 2005; Majchrzak et al. 2000; Tyre & Orlikowski 1994). An exception to this trend is the influence of perceived usefulness across all of the phases (refer the left column of Table 8.1). The current study only found perceived usefulness as an influence in three of the five phases considered; it did not emerge as an influence on pre-use or stabilised use. Consistent with prior research the current study found that the particular influences manifested across phases varied (refer the right column of Table 8.1). For example, contextual influences, which are similar to discrepant events, shaped adaptive use, and prior appropriations, which are similar to past use, shaped stabilised use. Nevertheless, there was large overlap in influences for initial use and continued use. Furthermore, functionality and usability were found to influence all phases but stabilised use. Overall there is some correspondence between prior research and the current study. The lack of complete correspondence is consistent with prior research. Even in the case of perceived usefulness there were five of 19 studies considered in Chapter 2 that failed to find a link with use or adoption (also see Appendix A).

A review of Table 8.1 shows that there were a variety of important influences in this study that were not identified in the literature as consistent influences (influences listed below the dotted lines), such as prior appropriations. The presence of influences over and above the commonly found predictors is not surprising. Previous research often identifies influences other than the best predictors (see Appendix A). Much of this can be accounted for by the inclusion of study specific measures. However, variability in the significance of influences occurs even when the same measures are employed (Diez & McIntosh 2009; Jeyaraj et al. 2006). The reasons for this could include diversity in: the types of IT artefacts examined, user cohorts and use contexts.

The current study went beyond much prior quantitative survey-based IS research by examining the valence or strength of views held by participants for a range of influences. As reported above, perceived usefulness was found in three of the five phases, with functionality and usability found in all but the stabilised use phase. Reliance on the presence or absence of influences as a marker of change could lead to the conclusion that these influences are quite consistent over time. Whilst their presence may be, the findings of this current study showed that users perceptions of usefulness, functionality and usability were more positive over time (denoted by '↑'). There appears to be a bias in quantitative IS research toward cross-sectional studies, which exclude consideration of the effects of time. Few IS studies adopt longitudinal research designs (Bhattacherjee & Premkumar 2004). Furthermore, even when longitudinal quantitative research is undertaken, the focus is on investigating links between independent and dependent variables via use of inferential statistics (Karahanna et al. 1999; Taylor & Todd 1995b; Venkatesh & Davis 2000; Venkatesh et al. 2000; Venkatesh et al. 2003). Consideration of changes in the valence of particular influences over time is excluded. By including an analysis of the valence and strength of influences over time, this study yielded a more nuanced and richer understanding of how influences on appropriation change.

What are the influences on appropriation in the Defence organisation and how do these influences compare with prior research? Across all phases there was reasonable correspondence between prior research and the current study with respect to influences on appropriation. Particular phases showed much greater correspondence than others. There was considerable overlap in the influences at the continued use phase, moderate overlap for adaptive and stabilised use, and little or no overlap for initial and pre-use. There were also a variety of important influences in this study that were not identified previously as important influences. Consistent with prior research, influences were found to vary across phases. For example, contextual influences were important in shaping adaptations, and habitual use in shaping stabilisation. Furthermore, the valence or strength of influences changed over time. There were also some influences that were important across multiple phases. Functionality, usability and prior appropriations were influential in four of the five phases, and usefulness for three phases.

8.2.3 Changes in patterns of appropriation over time

At the pre-use phase, prior research has investigated intentions to use or adopt a technology (Agarwal & Prasad 1998; Karahanna et al. 1999), or investigated the decision to adopt

(Mendoza et al. 2005, 2008) (see Table 8.2). The current study did not explicitly elicit such data. However, an indicator of possible adoption was the ranking of the AKD higher than extant systems. The current study also found evidence of non-adoption, with executive staff in the EDMS case choosing not to use the system (see right column of Table 8.2).

	Prior research	**Current study**
Pre-use (A,B)	Intentions to use/adopt Decision to adopt	No No
		(A - Possible adoption) Non-adoption (B)
Initial use (A)	Intentions to use/adopt Extent of use Adaptations to technology Adaptations to practices	Yes (A - Adoption intentions: intention to use) Not assessed Yes (A) Yes (A)
		Adoption intentions: information quality Adoption intentions: AKD more efficient Adaptation/Stabilisation: Nature of IS use
Continued use (B,C)	Intentions to use Extent of use: frequency Extent of use: amount Extent of use: number of applications/tasks Discontinuance/disappropriation Minimal use	Not assessed Yes (B&C) Yes (B&C: years of use, messages sent/received etc); Yes (B: number of documents and activities) No Yes (B: partial appropriations)
Adaptive use (B,C)	Adaptations to technology Adaptations to practices Adaptations to technology and practices - Nature of IS use (high) - *Habitual use (low)*	Yes (B&C) Yes (B&C) Yes (B&C) Yes (C) *Yes (C)*
Stabilised use (B,C)	Routine use - Habitual use (high) - *Nature of IS use (low)*	Yes (B&C: stabilisation) Yes (C) *Yes (C)*

A = AKD; B = EDMS; C = E-mail; ↑ = increase over time

Table 8.2 Patterns of technology appropriation by lifecycle phase

Non-adoption or rejection prior to use is clearly one of the possible outcomes of appropriating IT artefacts. It is reflected in the theories and models of Rogers and Carroll described in Chapter 2. However, the prior research considered here did not present evidence of non-adoption. The quantitative survey-based studies by Agarwal and Prasad (1998) and Karahanna et al. (1999) both collected data that would have supported identification of non-adoption or low intentions to adopt. For example, Agarwal and Prasad measured intentions to

use on a seven-point scale ranging from Strongly Disagree to Strongly Agree, where strong disagreement could have been used as an indicator of low future use intentions. But, such information is lost via the aggregation of the data that goes hand in hand with quantitative survey-based approaches to IS research. Furthermore, the study by Mendoza retrospectively asked trainees about their decision to attend the bibliographic software training. This would have excluded from consideration any people who chose not to adopt the bibliographic software prior to use because they would not have attended the training.

At the initial use phase, prior research and the current study assessed users' adoption intentions via measuring intentions to use IT artefacts in the future (Davis 1989; Davis et al. 1989; Venkatesh et al. 2003). The current study also inferred future use intentions from perceptions of the IT artefact (the AKD) being more efficient than existing systems and the artefact supplying better quality information. The current study found evidence of adaptations to IT artefacts, in particular personalisation and customisation (see section 8.3.1.2 for further discussion). Prior research has similarly found personalisation and customisation of artefacts, but also inventions, such as creating add-ins (e.g Desouza et al. 2007). However, inventions were identified sometime after the initial use phase. The absence of inventions at the initial use phase in the current study could be due to potential inventors needing additional experience using the artefact before being able to create add-ins or others forms of invention. Both the current study and prior research identified adaptations to practices (e.g Carroll et al. 2003a; Mendoza et al. 2005). This prior research has used the MTA, which despite evidence of adaptations during initial use has not represented such patterns of appropriation in the model, instead viewing such patterns as occurring after initial exposure. The enhanced MTA, discussed in section 8.4.2, addresses this weakness. The propensity for people to adapt their use or engage in stabilised use at the initial use phase was also inferred using Jain and Kanungo's (2005) Nature of IS use scale, although this scale has not previously been applied at the initial use phase. Even during initial use, a third of participants in the AKD workshops felt they used the system differently than others (adaptation). Conversely a third did not see their use as different from others (stabilisation). These finding indicate that users perceived their use as either heterogeneous or homogeneous respectively. Evidence of heterogeneity suggests adaptation has occurred, particularly where the nature of the task is kept relatively constant, as was the case in the AKD workshops. Likewise, homogeneity implies stabilisation. Whilst this measure is not a definitive indicator of the presence or absence of

adaptation and stabilisation, it does show that users' patterns of use diverge or converge with the patterns of others even during initial use.

The theoretical work of Rogers (1995) and Carroll (2004) includes non-adoption or rejection during initial exposure as one of the possible outcomes of appropriating IT artefacts. However, neither Rogers' persuasion and decision stages, nor Carroll's initial exposure phase clearly decouples pre-use and initial use. By decoupling these two phases of the IT lifecycle in the enhanced MTA, a more nuanced and contextualised account of users' reactions to IT artefacts is made possible. This decoupling also focuses empirical attention on drawing out the range of possible appropriation outcomes at each of these phases, such as the presence of adaptation and possible stabilisation during initial use.

The continued use phase forms part of the 'extent of use' lifecycle, as described in Chapter 2. Investigations of continued use draw on one or more measures of the extent of use, most commonly frequency and amount (e.g. Adams et al. 1992), and to a lesser extent the number of applications or tasks supported (e.g. Igbaria et al. 1995). All three of these types of measures were assessed in the current study. Of particular use in drawing out patterns of appropriation were those measures targeted at the feature level of IT artefacts. For example, the measures used in the e-mail case did not just convey the extent of use, but also the number of messages sent and received, the number of messages in the inbox, the number of folders and the frequency of checking and filing messages (see section 8.5.1 for additional discussion). Measurement at multiple data points also showed that patterns changed over time, such as the number of messages received, or remained quite stable, such as the frequency of checking and filing messages.

The adaptive use phase has been examined by both qualitative and quantitative IS researchers, although qualitative studies dominate. These studies have examined or identified adaptations to technology, practices or both (Carroll 2004; Desouza et al. 2007; Hayes 1999; Tyre & Orlikowski 1994). The current study also identified all three of these broad classes of adaptation using both qualitative and quantitative methods. Adaptations to technology at the adaptive use phase included customisations and inventions, but there was no evidence of personalisation. Examples of customisations included configuration changes to e-mail, such as message reminder settings. Invention occurred at an organisational level for EDMS, with the in-house development of a web-publishing solution for EDMS documents. The absence of

individual level inventions might have been due to the paucity of software development expertise of participants in the three cases. By contrast, the study by Desouza et al. (2007) in which individual level inventions were found, was based on interviews with 20 software engineers. The lack of personalisation at the adaptive use phase might be due to aesthetic changes being more likely to occur when users first start to use a technology, such as changing the colour of the AKD portal interface during initial use. The current study provides preliminary support to this proposition.

In the e-mail case, two quantitative survey based measures were used to identify the extent of adaptation or stabilisation in patterns of appropriation: nature of IS use and habitual use (Jain & Kanungo 2005; Limayem & Hirt 2003). The propensity of people to adapt was inferred by a high rating on nature of IS use, that is, a belief that one's use of the technology is different from others. It was also inferred by low scores on habitual use. These two measures were also used to infer the presence of stabilised use, where habitual use was rated high and the nature of IS use rated low. The findings from this case show that the majority of participants saw their use as habitual (12 of 16) and did not try new features in e-mail to make them more efficient than others (11 of 16).

Stabilised use has been conceptualised and measured in a variety of ways, including habitual use and nature of IS use considered above, as well as routine use (Orlikowski 1992; Tyre & Orlikowski 1994). There was clear evidence of some aspects of e-mail use being stable over time, such as the frequency with which the inbox is checked and messages filed. There was also evidence suggestive of stability in the EDMS case, with reports of widespread dependence and acceptance. Stabilised use, as for other phases, has been investigated using qualitative and quantitative research approaches, however, the later dominate. Whilst there are some examples of habit and related constructs being examined by quantitative survey-based researchers (Hong et al. 2008; Kim et al. 2005; Limayem & Cheung 2008; Limayem & Hirt 2003), it remains an under-investigated phase of the use lifecycle. This lack of quantitative IS research is perhaps due to the teleological foundations of much of this research, a foundation concerned with the role of beliefs, attitudes and intentions in shaping behaviour. When use of IT artefacts stabilises and becomes routine, prior patterns of behaviour play a much more substantial role in explaining current patterns of behaviour (Janis & Nock 2008; Jasperson et al. 2005; Ouellette & Wood 1998; Webb & Sheeran 2006). The quantitative findings from

this research support this view, with the two dominant influences – usability and usefulness – not identified as significant influences in the e-mail case.

One of the recognised outcomes of use over time is that at any time during the use lifecycle users may decide to not use a particular IT artefact (e.g. Carroll 2004; Rogers 1995) or endeavour to minimise their use (e.g. Hayes 1999; Mendoza et al. 2005). During pre and initial use, this decision translates into a decision not to adopt the technology, discussed above under pre-use. Following initial use, prior research has investigated minimal use (Hayes 1999), as well as the absence of use in terms of discontinued use (Pollard 2003) disappropriation (Carroll et al. 2003a), discontinuance (Bhattacherjee 2001) or continued rejection (Rogers 1995). The current study also identified non-adoption and minimal use, but not disappropriation or discontinuance.

Explicit investigation of minimal use, here referred to as partial appropriation, is quite limited (Hayes 1999; Mendoza et al. 2005, 2008). However, a concern with understanding why use might be less than desired forms an important sub-text to studies examining use from a quantitative survey-based perspective (Davis et al. 1989; Szajna 1996; Venkatesh et al. 2008). The measurement of the extent of use provides an opportunity to identify limited or discontinued use. However, there appears to be a bias in studies measuring the extent of use toward framing use in positive terms, that is, on identifying influences on use, not influences on minimal or discontinued use. There are exceptions to this, such as the work of Bhattacherjee and colleagues (Bhattacherjee 2001; Bhattacherjee et al. 2008; Bhattacherjee & Premkumar 2004). Moving beyond statistical inference to include analysis of patterns of use across individuals also supports consideration of minimal use or discontinued use. This is because aggregation is avoided, allowing the heterogeneity in patterns of appropriation to be more readily identified.

One of the elements of the MTA is that patterns of 'technology in use' are assumed to be heterogeneous across individuals (Carroll 2004). This proposition was strongly supported in all three cases and therefore across multiple phases of the use lifecycle. However, for certain features or tasks the patterns were more homogeneous. The ability to identify heterogeneity was due to opening up 'the black box' of IT by investigating individual's particular patterns of feature use and practices. The current study enhanced understanding of heterogeneous patterns of appropriation by identifying such patterns as a feature throughout the lifecycle.

What are the patterns of appropriation in the Defence organisation and how do these patterns compare with prior research? The current study drew on measures commonly employed to assess use or use intentions to assess both the extent and nature of use, as well as using measures targeted at adaptation and stabilisation (nature of IS use, habitual use). For example, the frequency of use of particular features assisted in identifying how much features were being employed, as well as the implications for practice of such use. Adaptations to technology and practices emerged once participants started to use the artefacts and persisted over time, which echoed prior research. The current study identified adoption, non-adoption, adaptation, stabilisation, and partial appropriations. However, unlike prior research no evidence of rejection was found, perhaps reflecting the mandated use context. Patterns changed over time both in extent and nature and patterns were heterogeneous across individuals, as in previous research.

8.3 Conceptual implications

This section will firstly analyse the implications of this study for some of the key concepts associated with the process of appropriation. The central concept of appropriation is also revisited, and positioned as going beyond the concept of system use in some important ways.

8.3.1 Concepts for understanding the process of appropriation

Key concepts associated with the MTA include: adoption and non-adoption; adaptation; appropriation or stabilisation; and disappropriation or rejection (see Figure 8.1).

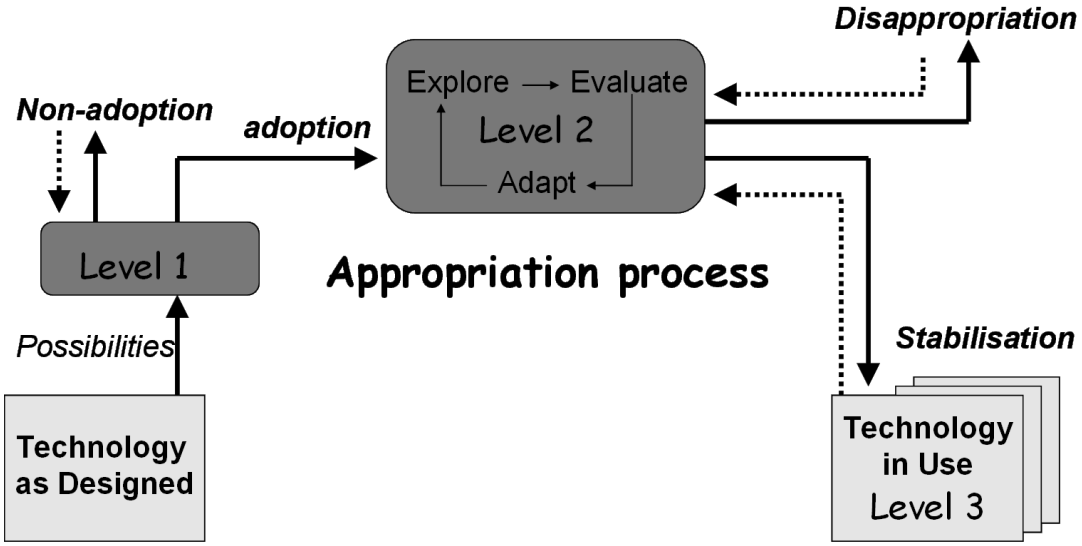


Figure 8.1 The MTA (adapted from Carroll 2004, p. 5)

8.3.1.1 Adoption

Adoption is a concept that is widely employed in the IS and innovation research communities (e.g. Agarwal & Prasad 1998; Carroll et al. 2003a; Chu & Robey 2008; Jeyaraj & Sabherwal 2008; Langley & Truax 1994; Mendoza et al. 2005; Rogers 1995; Venkatesh et al. 2007). Rogers (1995) defines adoption as "a decision to make full use of an innovation as the best course of action available" (p. 171). When considered in the context of his model of the innovation-decision process (see Figure 2.5), this definition covers both the initial decision to use an innovation, as well as continuing to decide to use an innovation, referred to as continued adoption. Researchers have also included pre-adoption as an additional phase that precedes the adoption decision and post-adoption or continued adoption (Jasperson et al. 2005; Karahanna et al. 1999). Adoption is also defined very broadly as being synonymous with the concept of technology acceptance (Agarwal & Prasad 1998; Venkatesh et al. 2007), which in turn is a concept composed of a cluster of concepts such as system use, behavioural intention, and user satisfaction (Davis 1989; Davis et al. 1989; Igbaria & Tan 1997; Taylor & Todd 1995a). The current study follows Carroll (2004) in framing adoption in terms of the adoption decision, which entails a decision to use an artefact or a decision to not accept the technology, referred to as non-adoption. The AKD case introduced an additional nuance to the adoption concept, adoption intentions (Karahanna et al. 1999), which occur prior to the adoption decision. This was introduced to convey the intention of users to adopt an artefact in the future. It was useful in the AKD case because participants were not given an opportunity to make an adoption decision. What this case also shows is that the period prior to adoption does not necessarily entail an absence of use, as is assumed in much of the research on technology adoption and use (Jasperson et al. 2005).

8.3.1.2 Adaptation

A concern with adaptation is a feature of research focussed on the nature of use. This research has examined adaptations to technology (e.g. Desouza et al. 2007), to practices (e.g. Hayes 1999), as well as mutual changes in technology and practices (e.g. Carroll 2004). The current study similarly distinguished between adaptations to technology and practices. In addition, technology adaptations were further differentiated as personalisations, customisations, and inventions (Desouza et al. 2007). Evidence was also found for a type of technology adaptation not covered by these forms, extensions or additions. This form of technology adaptation entails the introduction of software add-ons that extend the usability or functionality experienced by users when using the core application. Software add-ons were found in the

AKD and e-mail cases, such as the introduction of a corporate message archiving solution to underpin e-mail (Enterprise Vault), which provided users with automatic archiving of messages on servers.

Adaptations to practices were identified through: investigating changes in patterns of feature use over time, including changes in the extent of use of the system or system features over time; and changes in pre-existing practices due to the introduction of a technology. For example, changes in the frequency of sending or receiving e-mail messages over time, or having to perform additional steps to create a new document in MS Word as required by the EDMS.

An investigation of technology and practice adaptations shows that individuals vary with respect to volitional control over changes. Similar to system use, adaptations could be viewed as discretionary, mandated or captive (Adams et al. 1992; Henry & Stone 1997), where captive use conveys the sense of obligation people feel to use a technology in the absence of an explicit mandate. Personalisations, customisations and inventions seem to be discretionary, with the extension example above a form of captive adaptation. Adaptations to practice were mandated, captive and discretionary. Users of EDMS were forced to change their practices. Conversely, a number of e-mail users had some discretion over changing their practices, but were nevertheless obliged to use e-mail for core business functions. Discretionary, mandated and captive changes to technology or practice represent a set of descriptors that could be applied in future research to better differentiate adaptations.

The presence of both technology and practice adaptations in each of the three cases potentially indicates that mutual adaptation has occurred (Leonard-Barton 1988; Van de Ven 1986). A weak form of mutual adaptation could be implied by the presence of both forms when they are not closely situated in time, nor associated with particular individuals. This form of mutual adaptation is consistent with adopting the organisation as the primary unit of analysis (Leonard-Barton 1988). At an aggregated or organisational level, the invention of a web-publishing solution for EDMS was a response to problems sharing information with non-EDMS sites. This invention in turn changed how EDMS users provided access to documents for non-EDMS users – sending a link to the website rather than attaching a document. By contrast strong mutual adaptation would occur when there are successive changes in technology and practices for a particular individual using a particular IT artefact. The idea of

co-evolution is consistent with this view of strong mutual adaptation (Eisenhardt & Galunic 2000):

> "It refers to successive changes among two or more ecologically interdependent but unique species such that their evolutionary trajectories become intertwined over time…The result is an ecosystem of partially interdependent species that adapt together" (p.92).

When applying this biological metaphor to the IS domain, the technology and associated practices represent the species that adapt together. Detecting such strong mutual adaptation requires a longitudinal data collection approach that also provides rich data about patterns of use and associated practices. Of the three cases, e-mail is clearly the best example of this. For example, one person had changed their default sort setting for inbox to "from", presumably because this suited his message search practices. Over time the number of messages increased. At a certain point this search strategy started to fail, which led to a change in search practice, which was achieved through changing the default sort setting to "date". What this example shows is the intertwining of changes in practices and technology over time. A detailed analysis of the data to identify strong mutual adaptation is beyond the scope of this thesis. However, the above example points to value of doing so.

8.3.1.3 Stabilisation

Stabilisation is defined or described as what happens following an episode of change or adaptation (Lewin 1952), or as the opposite of change (Farjoun 2010). Stabilisation conveys the idea that patterns of appropriation have become habituated or routinised (Carroll 2004; Limayem & Hirt 2003; Orlikowski 1992; Rogers 1995; Sundaram et al. 2007; Tyre & Orlikowski 1994). Carroll (2004) has also used the term appropriation to convey stability. The MTA is a model that describes the process of appropriation, but it also includes appropriation as an outcome or temporary end-state of this process. Appropriation is framed as largely synonymous with stabilisation or incorporation. This could imply that the process of appropriation is the process through which people come to have stabilised patterns of use. However, the description of the process provided by Carroll (2004) - as that through which technology is evaluated by people over time and adopted, adapted and incorporated into their work practices – clearly has a broader intent. The word appropriation on the right side of the model was therefore removed and substituted with stabilisation, thereby reducing conceptual confusion (see Figure 8.1).

One of the features of prior research on adaptation and stabilisation is an explicit sequencing: adaptation is followed by stabilisation, which is followed by renewed adaptation (Carroll 2004; Tyre & Orlikowski 1994). What this implies is that stability and change are mutually exclusive and separate, that they are unable to co-exist (Farjoun 2010). This implication is also evident in the definitions of stabilisation provided above. However, the findings from the e-mail case suggest that adaptations and stabilisations in patterns of feature use can co-exist. A user can have stable patterns with respect to e-mail management, but also can make changes to their screen configuration, or their e-mail search behaviour. Stability and change can therefore co-exist across features and practices. The ability to discern co-existence requires a longitudinal analysis of patterns of feature use over time. It also requires researchers to let go of the tendency to over-emphasise the distinction between stability and change, to not see them as dualisms. Concepts frame what is seen and understood and how researchers choose to investigate a phenomenon of interest. Richer understanding of adaptation and stabilisation therefore requires a reappraisal of extant conceptualisations of adaptation and stabilisation, and how they are related. It also requires explicit acknowledgement of the role that methodology choice plays in determining what can be understood (Gable 1994; Lee 1991). Efforts to achieve this could build on similar trends in IS research and associated domains that endeavour to overcome dualistic assumptions in thinking (Farjoun 2010; Giddens 1986; Orlikowski 1992). The enhanced description of the MTA developing in this thesis incorporates the idea that adaptive use and stabilised use can co-exist (see section 8.4.2).

8.3.1.4 Additional patterns of appropriation

The process of appropriation not only describes the adoption, adaptation and stabilisation of technology over time, but also non-adoption and disappropriation. Non-adoption was considered above, and occurs during initial exposure to a technology. Disappropriation involves rejection of a technology following a period of use, or what other researchers have referred to as discontinuance (Bhattacherjee 2001; Rogers 1995), discontinued use (Pollard 2003), or abandonment (Wilson & Howcroft 2005). However, there are other possible outcomes of appropriation not captured by the MTA, such as disuse (Dzindolet et al. 2001), underutilisation (Jasperson et al. 2005; Venkatesh et al. 2008), or minimal use (Cushman & Klecun 2006), which all convey the use of system in a limited or partial way. The findings from the current study also identified limited use. To capture this idea the concept of partial

appropriation was introduced, defined as limited feature use, or the use of work-arounds to minimise use.

Another potential category of appropriation outcomes relates to use being more incorporated (Carroll 2004), integrative (Saga & Zmud 1994), infused (Saga & Zmud 1994; Sundaram et al. 2007), embedded (Baxter & Berente 2010) or institutionalised (Orlikowski 1992; Trice & Treacy 1988), as well as users being dependent on an IT artefact (Goodhue & Thompson 1995), or seeing it as a necessity for effective functioning (Whyte et al. 1997). In Chapter 2, these concepts were raised as examples of stabilisation. Whilst stabilisation is often a feature of such outcomes or patterns, they are not simply synonymous with stabilisation. These concepts are broader. They convey the embedding of a technology within a particular context, here described as embedded appropriation, defined as the thorough incorporation of an IT artefact with work practices, such that the artefact is a taken for granted part of a user's work life. Such embedded appropriation can involve both adaptation and stabilisation.

8.3.2 Going beyond use to appropriation

A variety of concepts have been employed to describe users' interactions with technology, but system use appears to be the dominant concept (Benbasat & Zmud 2003; DeLone & McLean 1992; Karahanna et al. 1999; McLean et al. 2002; Trice & Treacy 1988). Given the dominance of the use concept, why was it not chosen as the core concept for use in this study? The primary limitation of the use concept is the narrow way in which it tends to be measured and conceptualised, as the extent of use (Burton-Jones & Straub 2006). However, attempts have been made to define it more broadly as an individual user's employment of one or more features of a system to perform a task" (Burton-Jones & Straub 2006, p. 231). This definition supports classification of measures ranging from studies employing lean measures of use, where no reference is made to any of the three elements (user, system and task), with usage simply being construed as either the presence (very lean) or extent of usage (lean), through to richer measures that reflect the nature of usage, involving one (somewhat rich) or more (rich) of the three elements. A range of lean and rich measures were employed in this study because they provided a means of understanding some aspects of appropriation. So even though use was not the core concept it nevertheless is a key element of appropriation.

Appropriation is a broader concept than use, even as defined by Burton-Jones and Straub (2006). In bounding their conceptualisation they explicitly exclude information use, the

decision to adopt, user adoption, and user dependence. By contrast, appropriation is applied in a broad way in the current study. It includes all of the concepts considered above in section 8.3.1. In this way, it is analogous to similarly broad concepts like adoption, and acceptance.

Whilst particular concepts are not necessarily tied to particular methodologies, studies investigating the extent of use have tended to use lean survey-based measures, and employed inferential statistics (Burton-Jones & Straub 2006). Because of these choices, the range of behaviours explored is limited to those identified *a priori* and individual differences are reduced to means, standard deviations, and path coefficients. Constraining avenues of inquiry prior to data collection combined with frequent use of cross-sectional research designs means that quantitative survey-based research largely provides aprocessual, acontextual, and ahistorical accounts of system use and its antecedents (Pettigrew 1990). The concept of appropriation is intended to provide processual, contextual, and historically situated accounts of users' interactions with IT artefacts through use of multiple methods. Redefining system use in such a way as to overcome these constraints is considered unnecessary given that an existing concept, appropriation, already does so.

Research on system use has furnished the IS field with a comprehensive understanding of the variety of factors that influence usage, as exemplified by the development of the UTAUT model (Venkatesh et al. 2003). However, there is an emerging realisation within this quantitative survey-based research community that they have largely failed to attend to the dynamics of use and changes in use over time (Jasperson et al. 2005; Venkatesh et al. 2003). Understanding of dynamics is limited to differentiating between phases of use, as encapsulated in the extent of use lifecycle, which differentiates between pre-use, initial use and continued use. This provides a limited description of the dynamics as understanding of use is constrained to understanding movement from no use, through initial use and then ongoing use. The identity or character of use does not change. In contrast, the concept of appropriation includes the concepts of adoption, adaptation and stabilisation. These concepts describe qualitatively different phenomena, phenomena that differ in character. The concept of appropriation also foregrounds time. Appropriation focuses attention on the unfolding of users' interactions with IT artefacts over time, and the progression of events and associated dependencies, such as the movement through adoption, adaptation and then stabilisation (Van de Ven & Poole 2005). By contrast, the survey-based research community concerned with system use places time in the background (Van de Ven & Poole 2005). The amount of time is

uncritically applied as an indicator of experience, familiarity and routinisation (Venkatesh et al. 2003).The interest in time is also limited to providing distance between two measurements so as to determine the strength of the causal relationship, such as between behavioural intention and system use (e.g. Davis 1989).

Technology appropriation represents a broad concept that can take the form of a verb, a noun or a state. The latter form of appropriation is the final incorporation phase of the MTA where the practices around the use of the technology become routine, and no further adaptations to the technology occur (Carroll 2004). This form of appropriation has not been employed in this study, with stabilisation used instead, as discussed above. Appropriation as a noun is a particular instance of appropriation, which could include any one of the concepts considered in section 8.3.1. Appropriation as a verb describes the process of appropriation, the process through which technology is evaluated by people over time and adopted, adapted and incorporated into their work practices; and through which the design of technology is completed through use (Carroll et al. 2002a). Appropriation is therefore more than use. It includes cognitive, behavioural, and contextual outcomes: the decision to adopt, the adaptation of the technology or practices, and the incorporation of the technology with work practices respectively.

The definition of system use provided by Burton-Jones and Straub includes three key elements: user, system and task. The definition of appropriation above also includes the user and the system, but not the task. Instead, the focus is on practices. The shift from task to practices helps to draw attention to the employment of IT artefacts in the context of performing activities. Practices are the activities associated with getting work done (Brown and Duguid 2000). It is a term that encompasses a broader range of possible activities than is connoted by the term 'task', which is usually an "assigned piece of work often to be finished within a certain time" (Merriam-Webster online). The use of the plural form 'practices' rather than the singular 'task' is an acknowledgement of the diversity of activities associated with use of system features over time. An emphasis on particular tasks is in part driven by the influence of particular socio-cognitive theories, particularly the theory of reasoned action and the theory of planned behaviour (Ajzen 1991; Davis et al. 1989), within IS survey-based research. However, the importance these theories place on accurately predicting the particular tasks people perform comes at the expense of understanding "what binds together the variety of things that people do" (Abraham & Sheeran 2004, p. 106). There will remain occasions

where it makes sense to limit research attention to a particular activity but this should be done with awareness of the wider constellation of activities within which it is embedded.

8.4 Theoretical implications

Concepts, or constructs and factors, are one of the key elements of good theory (Grover et al. 2008; Whetten 1989). Now that the key concepts associated with understanding the process of appropriation have been considered, attention turns to examining the theoretical credentials of the MTA. Does the MTA make a theoretical contribution? How effective is the MTA in explaining users' technology appropriations in organisations? In what ways can the explanatory power of the MTA be improved? This section addresses these questions through considering the theoretical utility of the MTA, and through discussing the refinements and extensions made to the MTA in order to improve its explanatory power.

8.4.1 The MTA applied: A theoretical model for understanding variations in users' technology appropriations in organisations?

The MTA is composed of a diagrammatic representation of the process of technology appropriation for users, accompanied by a description and explanation of the process. One possible critique of the MTA might be to claim that it is just a model or diagram (Sutton & Staw 1995), that it is not a theory because it is strongly descriptive. However, such a position would be hard to reconcile with conceptual work on theory building (Gregor 2006; Whetten 1989). Two questions are particularly useful in identifying the theoretical credentials of the MTA:

- What constitutes a theoretical contribution? (Whetten 1989)
- What are the different forms that theories can take? (Gregor 2006)

What constitutes a theoretical contribution? There are four elements that constitute the building blocks of theory, which can be framed as secondary questions (Whetten 1989):

- What: What factors should be included to understand the phenomena of interest?

Answering this question is supported by reflection on the comprehensive of the factors included, as well as parsimony of the factors, that is, only including those factors that make a substantial contribution to understanding the phenomena of interest (Whetten 1989). The MTA is a model that is composed of core elements that describe the process of technology appropriation (the generic model). It is also a model that is intended to be contextualised for

particular user cohorts and technologies (the contextualised model). Judgements of the comprehensiveness and parsimony of the generic model require consideration of the extent to which the core elements apply across a range of cohorts and technologies. The model has been applied to describe the appropriation of mobile phones, bibliographic software, Short Messaging Service, e-mail, customer relationship management software, and open source software (Carroll et al. 2002c; Carroll et al. 2003b; Herszfeld et al. 2003; Heung 2002; Mendoza et al. 2005; Nor Zairah & Rose Alinda 2007). Such applications have largely retained the core elements of the model. In section 8.4.2 it will be shown that some modifications were required to the core elements to more effectively account for the phenomena of interest in this study. Nevertheless, the elements seem to be robust for a variety of user cohorts and technologies. Judgements of parsimony and comprehensiveness for the contextualised model require consideration of the MTA applied to a particular context. The identification of context specific influences on users' evaluations of a particular technology is obtained through the use of methods that support the emergence of important influences. As such, the influences identified by the above research represent those that were most salient for their participants. However, there is a danger of including long lists of influences that capture all of the salient issues raised by participants. The study by Carroll et al. (2003a) strikes the right balance with only five or so influences at each phase of the appropriation process. By contrast, the study by Ab.Rahim and Alias (2007) is comprehensive but probably fails to achieve parsimony due to listing a large number of influences.

The phenomena of interest in this thesis are users' appropriations of three IT artefacts in Defence. So what factors should be included to understand these phenomena? The MTA is a generic model, and as such does not explicitly include contextual features as core to the model. However, in refining and extending the MTA to suit organisations, the inclusion of context is required to ensure the comprehensiveness of the model. The particular inclusions are discussed in sections 8.4.3 and 8.4.5.

The contextualised model for the three cases includes a variety of influences and patterns of appropriation (see Figure 7.1, and also Table 8.1 and Table 8.2). This model represents a distillation of important influences and patterns from across the three cases. However, comprehensiveness is not balanced effectively with parsimony as it still includes quite a number of influences and patterns. The development of the enhanced MTA for organisation is an attempt to redress this balance (see sections 8.4.2, 8.4.3 and 8.4.5).

- How: How are the factors related?

The generic MTA follows a common strategy of using boxes and arrows. It is the arrows that convey how the core elements of the model are related (Whetten 1989). The model also places core concepts near to boxes and arrows, which similarly conveys relationships, such as that between appropriation (or stabilisation) and 'technology in use'. The model conveys the movement from 'technology as designed' to 'technology in use'. It conveys movement through the three levels of evaluation and the associated phase of the appropriation process. It also maps out the trajectory followed by users as they appropriate technologies: adoption, adaptation and incorporation with work practices. As Whetten (1989) argues, models perform the role of supporting theory developers and users in judging the completeness and parsimony of a proposed theoretical model. The contextualised model introduces case specific influences on users' evaluations. The generic and contextualised models both imply causality, causality in the paths taken by users as they engage in appropriation, and the causality of particular influences that shape evaluations and subsequent appropriation choices.

In the context of this research, the relationships between the core elements were mostly retained, although there were a few exceptions, such as broadening 'technology in use' to include both stabilisation and adaptation, or introducing pre-use and its link to initial use. The four phases of the use lifecycle were also explicitly incorporated. These additions are discussed further in the next section. Influences on users' evaluations and patterns of appropriation are summarised in Table 8.1 and Table 8.2 respectively (also see Figure 7.1). As discussed in section 8.2, there is some correspondence between prior research and the current study with respect to the particular influences manifested at different phases of the IT use lifecycle. The particular patterns of appropriation identified in prior research were also identified in the current study. In addition, the influences were linked with patterns of appropriation. However, why might these relationships have been manifested? This is the third building block of theory.

- Why: What is the underlying logic or dynamics "that justify the selection of factors and the proposed causal relationships?" (p. 491)

The underlying logic is the generative mechanism that sustains and generates the phenomena of interest (Contractor & Seibold 1993; Van de Ven & Poole 1995). The primary generative mechanism of the MTA is the imminent logic of a lifecycle theory of change. Change is

explained in terms of a sequence of phases through which the system of interest passes: adoption, then adaptation followed by incorporation or stabilisation. The progression through the phases is presumed to follow a certain imminent logic or sequence that is pre-programmed. The environment plays a role in lifecycle theories through influencing how the phenomenon of interest expresses itself. This is also the case for the MTA, where cohort and artefact specific influences on appropriation over time are identified. However, the events or influences are nevertheless mediated by the imminent logic (Van de Ven & Poole 1995). The limitations of the MTA in explaining why users' appropriations vary was raised in Chapter 2, and addressed by incorporating additional generative mechanisms, discussed in section 8.4.4.

- Who, Where, When: What are the limitations placed on the propositions generated by a theoretical model?

The MTA is proposed as a generic model of the process of technology appropriation for individuals interacting with a particular technology artefact. The ability to definitively test this proposition rests on being able to identify particular technologies and user cohorts for which the core features of the model do not hold. The MTA has not been widely employed. Nevertheless, the ten or so studies conducted to date provide some support for the general form of the MTA. Reflection on the findings from the current study, however, shows that some changes are needed to the core features of the appropriation process. A common feature of all of the technologies considered is that they are IT artefacts. Is the MTA intended to apply to all technologies or just those found in the context of IS research? This lack of specificity is a weakness of the generic MTA, but this weakness is offset somewhat by the MTA being a model that is intended to be contextualised for particular technologies and user cohorts. The act of contextualising the model introduces specificity with respect to the users, the technology and the context of use. The current study places additional limitations on the applicability of the MTA by contextualising it for organisations (see section 8.4.5).

The second question that assists in identifying the theoretical credentials of the MTA is: what are the different forms that theories can take? (Gregor 2006) Theories can be classified as descriptive, explanatory, predictive, explanatory-predictive, or as supporting design and action (Gregor 2006). Each type of theory provides different understanding of the phenomena of interest.

- Descriptive theories describe what is, based on empirical work (Gregor 2006). The genesis of the MTA was empirical work on the appropriation of mobile phones by young

people (Carroll et al. 2002a). The MTA when first formulated was an attempt to describe what happened as young people (aged 16 to 22) interacted with new phones over time.

- Explanatory theories are primarily concerned with how and why a particular phenomenon occurs (Gregor 2006). Such theories are often associated with process-based research approaches. Whilst the MTA describes the process of appropriation and to some extent provides an explanation of how and why this process unfolds over time, this explanation is limited to that provided by adopting a lifecycle perspective.
- Predictive theories aim to determine what will be, not why (Gregor 2006). Such theories therefore exclude consideration of generative mechanisms. Such theories are not common in IS.
- Explanatory-predictive theories represent those theories that accord with commonly held views about what theories should aspire to be, and are also the type of theories often found in IS (Gregor 2006). Such theories address "what is, how, why, when, and what will be" (Gregor 2006, p. 626). Consideration of the four building blocks of theory shows that the MTA clearly addresses all of these, although 'what will be' is considered as part of how factors are related. Relationships imply causation, which implies prediction. Furthermore, Carroll et al. (2003a) clearly intend their model to be of this type, even though it emerged out of empirical work: "[i]n order to predict and explain technology use […], we need to examine technology appropriation over time" (p. 47). Predictions are not framed in terms of statistical significance, nevertheless there are clear statements about and representations of relationships. For example, stabilisation follows adaptation, and the usefulness of mobile phones influences appropriation choices.
- Theories for design and action are about "*how to do* something" (Gregor 2006, p. 628). The work of Hevner et al. (2004) on design science is an example of this type of theory. Design science extends the capabilities of individuals or organisations through the creation of "new and innovative artifacts" (p. 75). Other examples of theories in this category include work on software engineering and systems development (Gregor 2006). The MTA as originally formulated is not a theory for design and action. However, subsequent work has extended the MTA by reflecting on how an understanding of the process of appropriation can be used to elicit requirements for new systems, and how to design systems that accommodate appropriation (Carroll 2004).

So, does the MTA serve as a theoretical model for understanding the process of appropriation in organisations? Does it make a theoretical contribution? The MTA addresses each of the

four elements that constitute the building blocks of theory: what; how; why; and who, where, when (Whetten 1989). All areas could be addressed more effectively, particularly the latter two. The development of the enhanced MTA for organisations represents such an attempt (see sections 8.4.2 to 8.4.5). What type of theoretical contribution is made by the MTA? The model is much more than just a descriptive theory. The lifecycle nature of the model and the variety of paths that users might take given particular influences shows that it is a theory for explaining and predicting.

8.4.2 An enhanced description: the appropriation process remodelled

Refining and extending theory is an important goal of this research, in particular, revising and augmenting the MTA so that it can more accurately account for variations in users' appropriations in an organisation context. This section discusses the revisions made to the core concepts associated with the generic MTA to more accurately account for users' appropriations of IT artefacts in the Defence organisation. The MTA and the enhanced description of technology appropriation are presented below (see Figure 8.2 and Figure 8.3, which is Figure 7.2 repeated)

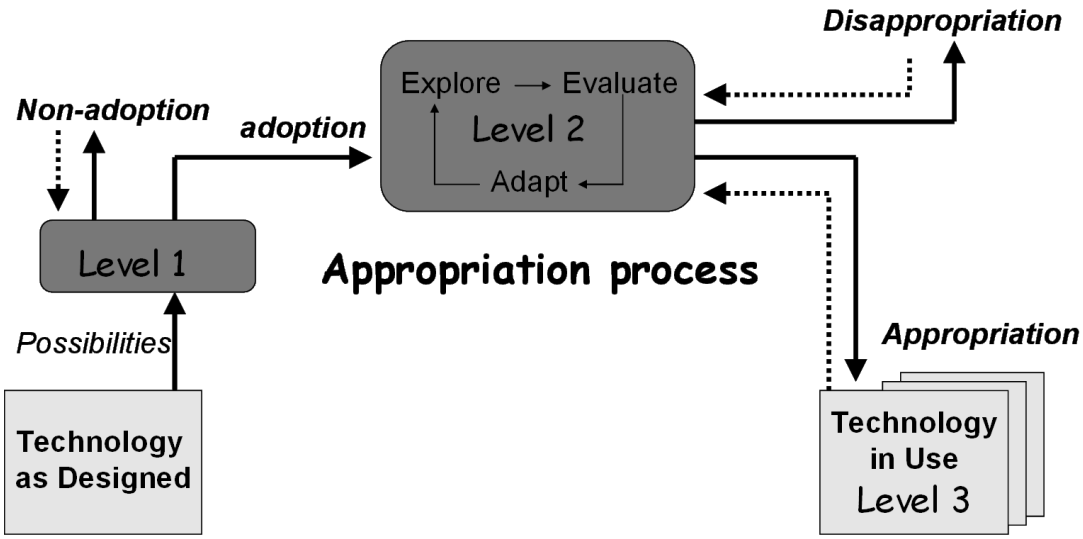


Figure 8.2 The MTA (Carroll 2004, p. 5)

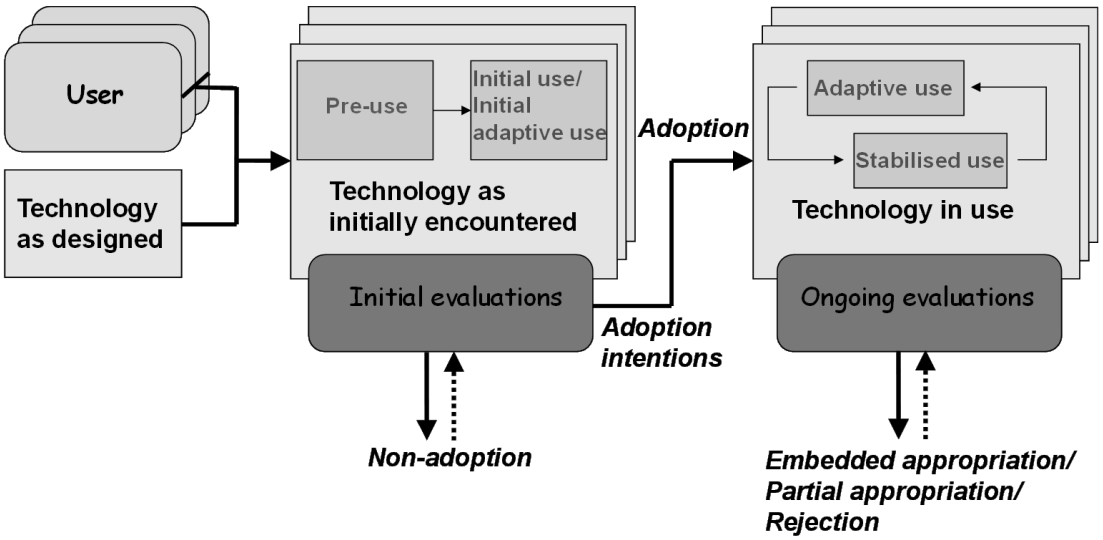


Figure 8.3 An enhanced description of technology appropriation

A comparison of the generic MTA with the enhanced description of technology appropriation shows that whilst a number of changes have been made the essence of the original model is retained. Nevertheless, a number of features have been modified or added to the MTA.

- The relationship between users and technologies throughout the process of appropriation is made more explicit through including the user and through explicitly representing users' initial encounters with a technology. Users' initial encounters with a technology represent the coming together of the user with the 'technology as designed'. If adoption occurs then users transition to employing the technology in the context of their work practices, referred to as 'technology in use'.
- The MTA was selected because it covers all four phases of the IT use lifecycle. However, it does so in a way that fails to decouple pre-use and initial use during users' initial encounters with a technology. The AKD case clearly showed the value in drawing this distinction, a distinction which is also made by some IS researchers (e.g. Bhattacherjee & Premkumar 2004; Karahanna et al. 1999). The process of adapting a technology and then reaching a state of appropriation were also changed to adaptive and stabilised use, so as to be consistent in how the four phases are described.
- The MTA implies that users' appropriation choices, including adaptations, only occur following a decision to adopt the technology. This research shows that adaptations can form part of initial use. Prior research using the MTA has described such adaptations, but these were downplayed and not represented in the model (e.g Carroll et al. 2003a; Mendoza et al. 2005).
- Heterogeneity in patterns of appropriation across individuals is represented by stacked boxes in the MTA and is associated with 'technology in use'. The AKD case also showed

that variation in patterns occurred across individuals even during initial encounters. Consequently, stacked boxes were added to the initial encounter component.

- 'Technology in use' is expanded and redefined to be more than a state of appropriation or stabilisation. It is here defined as employment of technology in the context of user's work practices. Such employment can involve adaptation and stabilisation in patterns of appropriation.
- Associated with this reframing of 'technology in use' is the potential for concurrent adaptation and stabilisation through positioning adaptive use and stabilised use as operating in parallel. The e-mail case showed that when patterns of feature use were tracked over time that adaptation and stabilisation can co-exist. Conceptual work on stability and change supports this finding (Farjoun 2010)(refer section 8.3.1.3 for further discussion). This concurrency is also contrary to the change process that underpins the MTA and many other change models; a change process typified by a set of starting conditions, an emergent process of change, and an end point or state (Carroll et al. 2001; Van de Ven 1992). In the enhanced description there is no end point.
- There are a range of outcomes that can result from a particular user's appropriation trajectory. The MTA includes non-adoption, adoption, disappropriation and appropriation as specific outcomes. As previously discussed, appropriation was replaced by stabilisation, which was in turn framed as stabilised use. Disappropriation is replaced by rejection. Additional outcomes incorporated in the enhanced description are adoption intentions, partial appropriation, and embedded appropriation.
    - Adoption intentions are a precursor to the decision to adopt. In the AKD case, users were not provided with an opportunity to make an adoption decision. They clearly expressed their adoption intentions however. The addition of adoption intentions improves the utility of the MTA for technologies that are being evaluated prior to purchase, or for technologies that are immature or developmental.
    - Partial appropriations entail limited use of features, or the use of work-arounds to minimise use. The current study found evidence of such partial appropriations.
    - 'Embedded appropriation' is included to convey the thorough incorporation of an IT artefact with work practices. It is a type of appropriation outcome that is well suited to describing systems like e-mail. Embedded appropriation may involve adaptation and stabilisation. Refer to section 8.3.1.4 for detailed discussion of these concepts.

- The description of the MTA makes clear that evaluations occur throughout the process of appropriation, labelled as level 1, 2 and 3 evaluations in the model. However, such evaluations are not consistently represented throughout, with only level 2 explicitly including evaluation in the model. The enhanced description associates evaluations with 'technology as initially encountered' and with 'technology in use'. Level 2 and 3 evaluations are collapsed into 'ongoing evaluations', since 'technology in use' entails both adaptive and stabilised use. Ongoing evaluations encourage or discourage various patterns of appropriation, including potentially concurrent adaptive and stabilised use.

Features contained in the MTA were also removed.

- The explore-evaluate-adapt loop is associated with the adaptation phase of the MTA. It was removed as these concepts are implied or covered elsewhere in the enhanced description. Evaluation is a feature throughout the process. Exploration underpins the initial encounter with a technology, as well as being associated with adaptive use. Adaptation is covered in 'technology in use'.
- Technologies present users with a variety of possibilities for action. Such possibilities for action are an inherent part of users' initial evaluations of a technology. They might also form part of users' ongoing evaluations, such as when users discover a new feature through observing the behaviour of others. 'Possibilities' was not therefore included in the enhanced description.

8.4.3 An enhanced description: a multidimensional view of context

The MTA is a generic model of technology appropriation. It therefore does not explicitly represent context. The development of an enhanced description suited to organisations represents a contextualisation of the generic model. A consistent finding was the pivotal role played by contextual elements in shaping users' evaluations and subsequent appropriations of particular artefacts. The contextual elements can be broadly categorised as organisational, technical and personal (Linstone 1999). The organisational context was investigated as part of the construction of case descriptions. It included such things as roles, structures, culture, processes, and history. Considering the organisational context provided understanding of the corporate rationale associated with the choice of particular artefacts, as well as artefact development and implementation processes. The technical context contained the variety of IT artefacts and associated infrastructure with which the artefacts of interest were associated. An understanding of the technical context provided a means of comparing the artefacts of interest

with previous or existing systems with similar functionality. The personal context was assessed through examining user attributes, such as demographics, their attitudes towards computers in general and competence in using the artefacts. These three elements are incorporated in the enhanced MTA for organisations (see Figure 7.5).

Two additional elements were identified at the intersection of the personal and technical contexts: prior appropriations and technology portfolios (see left and right side of Figure 7.5 respectively). Prior appropriations are user's previous experience with and patterns of use of the same or similar technologies in a particular use context. Prior appropriations also include how much exposure users have had with a particular artefact, or related artefacts. In all cases, the artefacts of interest were shaped by prior appropriations. In the AKD and EDMS cases, perceptions and patterns of appropriation were informed by prior appropriations of similar technologies, such as the MS Windows and paper based filing systems that preceded EDMS. In the case of e-mail, prior appropriations of e-mail were found to influence subsequent appropriations. Psychological research shows that past behaviour is one of the strongest predictors of current behaviour (Janis & Nock 2008; Ouellette & Wood 1998; Venkatesh et al. 2002; Webb & Sheeran 2006). However, the role of prior behaviours is under-researched in IS (Jasperson et al. 2005; Kim et al. 2005). This situation may be due to the dominance of cognitive rational theories in IS such as TAM, which draw attention to the role of beliefs and attitudes in shaping intentions and behaviours. Such theories assume that people always think before they act, that they engage in conscious cognitive work (Louis & Sutton 1991; Pfeffer 1982). However, the current study shows that the use of artefacts, like e-mail, that have become taken for granted and are part of the work landscape, is also shaped by prior appropriations. This dominance of cognitive-rational theories remains even though there is clear acknowledgement that such theories may not be well suited to use contexts characterised by habitual routines (Venkatesh et al. 2003). The tendency to ignore prior appropriations may also be due to a pro-innovation bias (Rogers 1995), or bias toward investigating prototype or recently implemented systems, or perhaps the strong tradition of undertaking single data point cross-sectional survey-based studies in IS research. Whatever the reasons might be, consideration of prior appropriations, or past use, yields insights into the reasons for users' patterns of appropriations.

Technology portfolios represent a mix of complementary technologies used by people to support their practices (Carroll 2005). Carroll (2005) applied this metaphor to the IS domain,

to help make sense of users technology choices and practices whilst mobile. Even though mobile devices continue to incorporate functionality previously located in separate devices, such as phones with GPS and cameras, users do not necessarily jettison the separate devices, their standalone GPS systems and cameras. The application of this metaphor to the current study was not decided *a priori*. Instead, it became clear that such a metaphor could assist in making sense of how people come to appropriate IT artefacts positioned within a particular technical context; how they come to adapt their practices and associated patterns of technology use. For example, prior to the introduction of EDMS, users document and information practices were supported by a variety of paper and network storage based systems. After the introduction of EDMS, the majority of participants were employing EDMS *and* network storage *and* paper. They were employing a portfolio of complementary technologies. EDMS supported improved document and information management, and paper and network storage provided ease of access and ease of use, and familiarity. The power of the portfolio view is that it helps make sense of the taken for granted aspects of work life, the uninteresting, the hidden, the routine, as well as how these aspects are affected when exposed to new IT artefacts ostensibly introduced to improve what is taken for granted.

IS research that fails to situate the phenomena of interest in a wider personal, technical and organisation context is unable to employ the portfolio metaphor (Pettigrew 1990). Such research tends to be variables-centred which focuses on "abstracting the phenomena of interest to constructs" (Ramiller & Pentland 2009, p. 476). Such research also sets aside the taken for granted the uninteresting, the systems that are "long in use" in order to focus on the highly visible, interesting, and often new artefacts (Baker 2007). The irony is that both co-exist, the new sits alongside of the old, and yet this is not often attended to in IS research. The utility of the technology portfolio view in this study it that it brought together the old and the new, it provided a more complete understanding of the role of context in shaping patterns of appropriation.

Incorporating technology portfolios into the enhanced MTA provides a more nuanced view of the particular contextual features that shape and influence patterns of appropriation. It also opens up an expanded view of adaptation in terms of additions or extensions. Extensions are new applications or 'add-ons' developed or introduced with the intention of enhancing the artefact of interest in some way: Retina was incorporated into the AKD, a web-publishing

solution was developed for EDMS, and enterprise vault was incorporated with e-mail (see section 8.3.1.2 for further discussion on conceptualising adaptation).

8.4.4 An enhanced explanation: generative mechanisms

The MTA was selected because it describes the process through which users, appropriate technologies over time and because it covers the entire IT use lifecycle. Being a lifecycle model, the MTA primarily explains change in terms of a sequence of phases through which the system of interest passes: first adoption, then adaptation and incorporation. However, the MTA is limited in its ability to explain the how and why of the appropriation process. It was proposed that this constraint could be overcome by juxtaposing additional theories of change and their associated generative mechanisms (see section 2.4). This is because particular theoretical perspectives serve as metaphorical devices or lenses that draw attention to particular features or qualities whilst also leaving out others. Figure 8.4 below (Figure 7.4 revisited) attempts to captures the way in which each perspective frames understanding of the process of technology appropriation. In each of the case study and cross-case chapters the findings were examined using each of the four theories of change: lifecycle, teleology, dialectics and evolution.

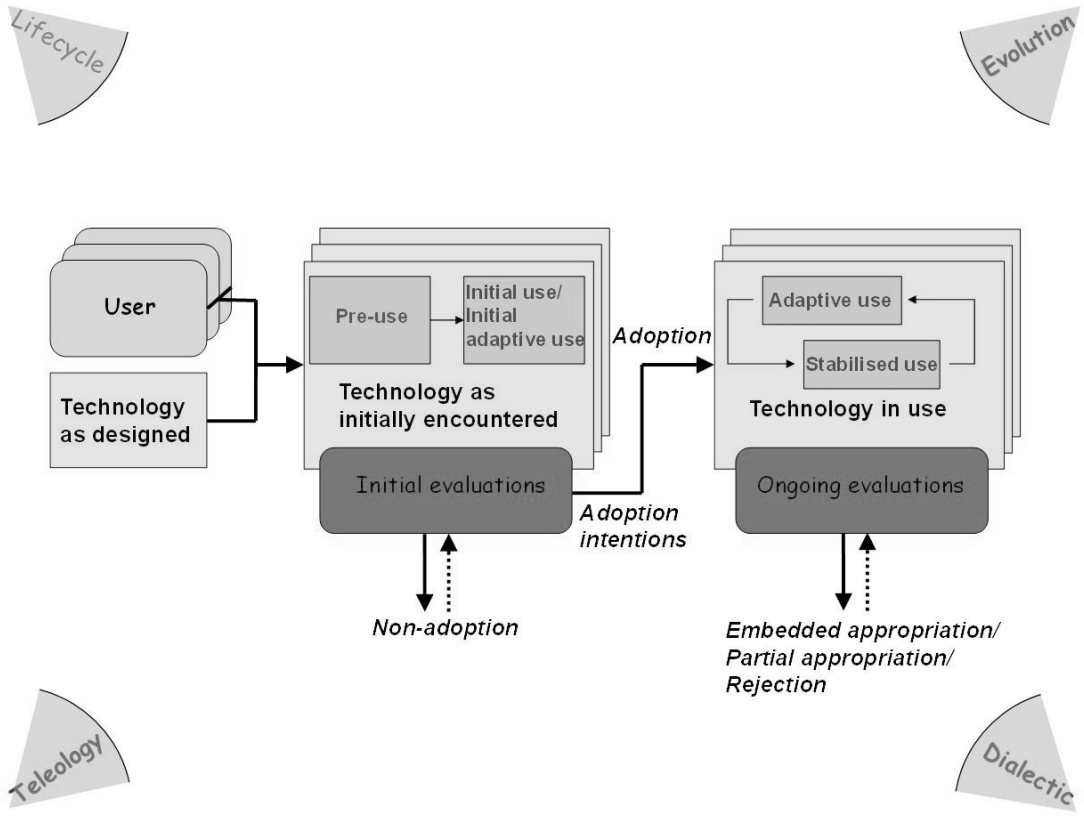


Figure 8.4 An enhanced explanation of technology appropriation

8.4.4.1 Lenses

Lifecycle models provide descriptions of process; in the case of the MTA, the process of appropriation. The research conducted here identified ways of enhancing the descriptive power of the MTA. The changes made to the MTA have produced a richer description of the process of appropriation (see section 8.4.2 and Figure 8.3). The enhanced description of appropriation that was developed has produced a more nuanced view of the phases and outcomes associated with the movement of users through the process of appropriation. An additional extension to the process description is the inclusion of prior appropriations as part of the wider context. At what point does the appropriation process begin? It begins when the user is presented with a particular technology for the first time. However, users are not empty vessels. They bring with them certain experiences that shape how they make sense of the new technology, that influence what they believe will be possible to achieve using the technology. Where prior appropriations relate to experiences of similar technologies, they can be thought of as the interface between two processes of appropriations for similar technologies. For example, the AKD case brought together a legacy knowledge management system in ADEL, with a proposed replacement, the AKD. ADEL was a 'technology in use', but in the context of the AKD prototype it also represented prior appropriations that strongly influenced how the AKD was evaluated.

The teleological perspective drew attention to the pursuit of goals, both individual and organizational, for each of the three cases. It brought into relief the role of various beliefs and attitudes in shaping intentions, choices and actions. Most of the influences investigated or identified in this research were beliefs and attitudes toward the IT artefacts of interest that shaped users appropriation choices and behaviours (see section 8.2.1 and Table 8.1). Nevertheless, there were influences for which a teleological perspective was unable to account: prior appropriations, discrepant events and habitual use. This is because these influences do not entail perceptions of a system but instead relate to contextual triggers or prior patterns of use. A review of Table 8.1 shows that two of these three influences, prior appropriations and habitual use, were important at the stabilised use phase, that is, they influenced the occurrence of stable patterns of use. It is also important to note that none of the pre-defined influences in the e-mail case were correlated significantly with the extent of use. A teleological lens therefore appears more suited to understanding users' initial encounters with a particular technology and their adaptations to the technology and associated practices over time. It is not as useful for understanding stabilised patterns of use.

Dialectic theories explain stability and change by reference to the tension that exists between opposing or contradictory forces, such as that between advocates of the status quo, the thesis, and those promoting change, the antithesis (Van de Ven & Poole 1995). Maintenance, substitution or synthesis are the outcomes resulting from these tensions. In this research, a dialectic perspective was particularly well suited to explaining the positioning of the artefacts of interest within users' technology portfolios, within which all three possible outcomes were observed. The use of EDMS alongside of pre-existing paper and network based systems represented a synthesis between the old and the new. Substitution occurs when the thesis is replaced by the antithesis. For example, the practice of organising social activities via e-mail (the thesis) was replaced by using instant messaging for this purpose. However, the uptake of instant messaging was limited, with most participants maintaining their particular technology portfolios in a form that pre-dated the introduction of this system.

An evolutionary perspective explains change as occurring through a continuous process of variation, selection and retention (Van de Ven & Poole 1995). Variation results from random or unpredictable changes or events, such as reliability problems or accidents. Selection occurs through competition for scarce resources in the environment. Time and effort were important resources that shaped patterns of appropriation in all three cases. Retention refers to maintenance of an entity's form; which serves to counteract the impetus for change created by variation and selection. Inertial forces were apparent in both the EDMS and e-mail cases, through maintenance of pre-existing practices and associated technologies or as evidenced by stable patterns of use. Evolution can be gradual and incremental, but it can also be episodic or punctuated by large changes in the form of entities, which in this case are patterns of appropriation. Prior research on the use or appropriation has argued that the process evolves incrementally (Mendoza et al. 2007) or is episodic (Tyre & Orlikowski 1994). The results from the e-mail case suggest that both are manifested. The findings were classified in terms of how substantial the changes were in patterns of appropriation between two time points. All of the 16 interviewees reported some change in extent of appropriations. Three interviewees experienced small or minor changes, such as an increase in messages received due to starting a university course. Moderate changes were described by four people, for example, the use of instant messaging for some informal communications instead of e-mail following its introduction. A further nine individuals experienced large changes, such as one individual who had moved all of his archived message dating from 2002 back into his inbox, as well as

no longer filing internal correspondence, due to the introduction of a corporate e-mail management and archiving system (Enterprise vault). Small to moderate changes were incremental in nature, large changes tended to be episodic leading to substantially different patterns of appropriation (refer Table 6.10 for the summary of changes for all 16 e-mail participants).

8.4.4.2 Transitions

Each of the four generative mechanisms provides a lens through which the phenomena of appropriation can be viewed. They also can be combined together to assist in explaining the genesis or transitions between changes (Van de Ven & Poole 1995). For example, an evolutionary lens (primary motor of change) can assist in explaining why a decision is taken to change patterns of appropriation (secondary motor: teleological). It explains a decision to change behaviour based on a random or accidental impetus. For example, in the e-mail case one individual had previously kept all deleted items just in case he needed them, but *accidentally* deleted them one day and "the sky didn't fall in". From this point on he *decided* to be "a little more ruthless in culling things". Similarly, another person had *accidentally* bulk deleted the messages in her inbox with no consequences. She subsequently *decided* to consciously bulk delete messages. In both cases, they became consciously engaged following a discrepant event (Louis & Sutton 1991). Table 8.3 summarises the variety of sequences between the four theories or motors of change. Four of the 16 possibilities represent sequencing associated with a single motor of change (diagonal cells running from top left to bottom right), for example, the sequencing of beliefs, attitudes, intentions and behaviours within cognitive rationale theories. This leaves 12 possible combinations of different change motors. However, only nine were identified as no examples could be found where a lifecycle perspective can be used to explain a transition or genesis for the other three perspectives.

Each of four theories of change provides unique insights into the process of technology appropriation. They also can be combined to explain the genesis of transitions between changes in patterns of appropriation.

	Secondary motor			
Primary motor	Lifecycle	Teleology	Dialectics	Evolution
Lifecycle	*Reason for changes in phases, e.g. patterns of appropriation following a set sequence. Or maintenance of stabilisation due to habit formation. For example, the maintenance of some habitual patterns when using e-mail draws this out.*	? (= lifecycle to teleology)	?	?
Teleology	(=teleology to lifecycle) Reason/s for changes in appropriation phases inc. initiation of cycle: e.g. decision to purchase/ implement / adopt the technology, such as decision to purchase an EDMS solution kicking off the appropriation process for individuals.	*Sequencing of beliefs, attitudes intentions and behaviours within cognitive- rationale frame of reference. E.g. usability influences acceptance (assessed via behaviour intention, use etc)*	Decision to introduce new technology/ procedures represents the introduction of an antithesis to extant technologies and/or practices.: e.g. Decision to include Retina separately in the evaluation workshop led to tension between Retina and the prototype portal	The decision to introduce a new technology (or new features or practices) can be seen as a new organism being introduced into an existing ecosystem that can lead to unintended outcomes (variation), new selection pressures, and the counterbalancing effect of retention. E.g. use of extant practices preferred to those procedures assoc. with EDMS.
Dialectics	Reason/s for changes in appropriation phases inc. initiation of cycle: e.g. extant IM practices versus mandated use of EDMS and associated procedures leading to disappropriations/ adaptations (movement from adoption to adaptation)	Tension created by an existing dialectic may trigger decision to purchase or implement, or adopt, adapt and reject: e.g. dissatisfaction with e-mail for short messages led to decision to adopt IM	*The presence of entities in tension helps to explain the genesis of syntheses – such as the manifestation of ICT portfolios.*	Introduction of antithesis (new tech/procedures) leads to renewed competition for scarce resources. Which in turn lead to selection of the best fitting "entity". I.e. dialectic tension as trigger for new selection process
Evolution	Reason/s for changes in appropriation phases inc. initiation of cycle: e.g. an accident (variation) triggering a shift from stabilisation to renewed exploration and adaptation, such as accidental block deletion of messages leading to exploration/adaptation.	Random impetus to then decide to change behaviour: e.g. loss of work leading to minimal use; loss of messages leading to new block deletion practice etc.	Evolutionary variation as trigger for dialectics. E.g. the accidental deletion of messages leading to two alternative practices: block deletion or the old practice of reviewing all messages.	*Consideration of variations, selections and retentions over time help to explain the evolution of appropriations over time.*

Table 8.3 Sequencing of change motors

8.4.5 An enhanced MTA for organisations

This thesis has demonstrated that the MTA has utility as a theoretical model for understanding users' appropriations of technology in organisations. However, it is somewhat limited with respect to its explanatory power. The model has also had limited application to organisational domains. The development of the enhanced MTA for organisations (see Figure 8.5) represents the culmination of the refinements and extensions made to the MTA so that it more accurately accounts for users' appropriations of IT artefacts in the Defence organisation. This model enhances the MTA through: modifying core elements of the model; explicitly including contextual features, and incorporating teleological, dialectic and evolutionary generative mechanisms.

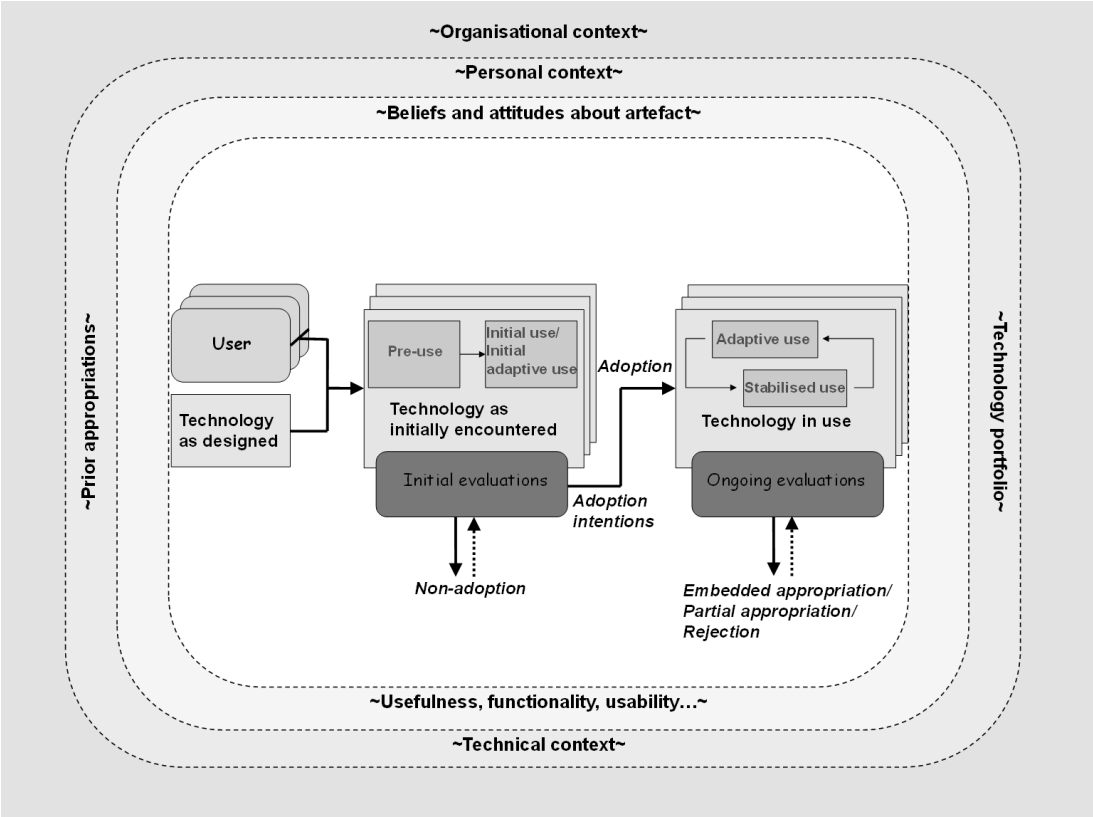


Figure 8.5 An enhanced MTA for organisations

Two important questions need to be addressed before the theoretical model presented above can be offered up to IS research:

- What are the domains of applicability of the enhanced model?
- Does it make an important theoretical contribution?

8.4.5.1 Domains of application of the enhanced model

The three cases used in this research were drawn from Defence, an organisation of some 90000 people containing a combination of military and civilian personnel and a variety of groups ranging in size from a couple of thousand to tens of thousands. Defence is not a business; it serves the Australian government in achieving its strategic objectives. So can the theoretical model presented above be viewed as one suited to organisations in general? The rationale for selecting Defence was that it represents an organisational context which manifests strong structural and cultural imperatives to control use. Such controls might be expected to limit adaptations and variability in patterns of appropriation across individuals and over time. The MTA, however, does not place limitations on its applicability based on social, cultural or organisational imperatives to control use. Instead it is a generic model that broadly predicts that adaptations to technology and associated practices will occur over time and that patterns of appropriation across individuals are likely to be heterogeneous. The same broad predictions[36] are captured in the enhanced MTA. Despite these structural and cultural imperatives, the findings supported the predictions made by the MTA, and by implication the enhanced MTA. This suggests that the enhanced MTA will have utility in less constrained organisational contexts. This finding is consistent with prior research which suggests that although users are heavily influenced by their organisations, they still have some discretion over how they employ a particular artefact (van den Hooff 2005).

A further means of addressing the applicability of the enhanced model for organisations in general is to reflect on the specificity of the concepts contained within the model. The MTA aims to be a theory that is middle level, neither specific to a particular artefact or cohort, nor an all-embracing theory of social phenomena, like structuration theory (Carroll & Swatman 2000). The enhanced MTA also represents a mid-level theory, but one that has increased specificity by including a wider range of appropriation outcomes, contextual features, and common influences. Clearly, the enhanced MTA for organisations has not been applied in non-Defence organisations. Nevertheless, the mid-range nature of the theory suggests it would have utility more widely in both constrained and less constrained organisational contexts.

[36] In this context 'broad predictions' are distinguished from point predictions. Such predictions are the most likely form in IS given the complexities associated with the phenomena of interest. Broad predictions are probabilistic. They involve uncertainty. In particular contexts the level of uncertainty may be quite small (i.e. almost deterministic) but in others it could by completely uncertain (emergent) *(Freeman & Soete 1999)*. The claim being made here is that levels of uncertainty will fall between these two extremes in most cases, and therefore one should only aspire to or expect broad predictions.

The enhanced MTA for organisations was developed following reflection on the findings from three case studies that provided overlapping coverage across the process of appropriation, and the four lifecycle phases. As discussed in section 7.2, the three cases share both similarities and differences with respect to the nature of the IT artefacts, the practices with which they are associated and the organisational contexts. All artefacts provided functionality to support users' information management and retrieval practices, however, e-mail also supported communication and was a mature technology. The AKD prototype was distinct due to the in-house development of the prototype portal component using open-source software, and due to not being available in the workplace. EDMS differed from the other two cases since its use was explicitly mandated, as was the training. When combined with the range of IT artefacts and associated practices considered by studies using the original MTA, the enhanced MTA would appear well suited to a variety of IT artefacts and practices. The modifications made to the initial phase of the MTA have also improved the utility of the enhanced model for understanding all four phases of the IT use lifecycle.

Whilst the theoretical model presented above is specified for organisations, all but one of the changes made to improve the explanatory power of the MTA are not specific to organisations. The only feature specific to organisations is the outermost 'organisational context' band. The enhanced MTA for organisation could therefore be proposed as an enhanced MTA, with 'organisational context' changed to 'wider context'.

Despite the potentially wide applicability of the enhanced MTA for organisations, it is by no means universally applicable. It is less clearly suited to situations where the phenomena of interest is normative (social) or organisational perceptions of the patterns of appropriation of others or employees, such as abuse, disuse, effective use, or misuse (Cavanagh 2004; Dzindolet et al. 2001; Parasuraman & Miller 2004; Weber 2004). Whilst violation of certain social norms, such as sending spam messages, served as a negative influence on the appropriations of some e-mail users, such abusive use of technology was not included as patterns of appropriation in their own right. This is because they were only raised in reference to the behaviour of others, not as part of participants' own patterns of appropriation. Extending the model to include such outcomes is considered inappropriate, since the model is focussed on individuals' appropriations, not individuals or organisations perceptions of others appropriations. It would only be appropriate to include abuse of technology in the model if individuals construed their own use of an IT artefact in this way. Disuse entails

underutilisation of the artefact, but by whose reckoning? As was seen in the EDMS case, users' attempts to minimise use of the system were driven by experiences of losing work, a choice which they would judge as rational but which designers and implementers may judge as misguided underutilisation that is reducing the organisational level utility of the system. The same can be said for effective use, since this again is based on the judgements of others. Misuse involves over reliance on a system, such that malfunctions are not detected and use continues (Parasuraman & Miller 2004), or features are not well understood and therefore errors occur without the user's knowledge. The loss of work in the EDMS case was claimed by support staff to be due to misuse, which was in turn influenced by problems with the usability of the system. Such outcomes are not reflected in the enhanced MTA since they are normative. Clearly a normative view of IT artefacts and their appropriation over time would be an important contribution to IS research, the enhanced MTA was not designed for this purpose however.

8.4.5.2 Theoretical contribution

The question of domains of applicability, covered in the previous section, relates to one of the four elements that constitute the building blocks of theory (Whetten 1989), that being the limitations placed on the propositions generated by a theoretical model (who, where, when). The remaining three elements cover the factors that should be included to understand the phenomena of interest (what), how factors are related (how), and what is the underlying logic or dynamics (why). The MTA was found to address all four elements, although all could be addressed more effectively, particularly limitations, considered above, and the underlying logic. The 'what' element is enhanced through: developing a more nuanced view of the core appropriation process; bringing in context, and in particular prior appropriations and technology portfolios; and including usefulness, functionality and usability as important influences on appropriation choices. The 'how' element is improved through introducing additional linkages, such as between adoption intentions and adoption or between the contextual features and the core of the model. The 'why' element is enhanced through incorporating the four theories of change and their associated generative mechanisms.

An additional criterion for judging the quality of a theory is falsifiability (Weber 2010). Is it possible to find or think of instances where the theoretical model is inaccurate or wrong? A number of changes were made to the core of the MTA in responses to the MTA not correctly representing what was found. For example, adaptations occur during users initial encounters,

not just following the adoption decision. Furthermore, adaptation and stabilisation are not just related in a serial way, they are also able to co-exist. Such changes show that the MTA is falsifiable. Given the similarities between the enhanced MTA and the MTA, this suggests that the enhanced model is also falsifiable. For example, are prior appropriations and technology portfolios universally applicable in organisations? Are usability, usefulness and functionality always influences on users appropriation choices and behaviours?

8.5 Methodological implications

What researchers attend to is in part influenced by their methodological choices. For example, quantitative survey based research tends to provide aprocessual, acontextual, and ahistorical accounts of system use and its antecedents (Pettigrew 1990; Ramiller & Pentland 2009). This section considers some of the key features of the study methodology that facilitated examination of the process of technology appropriation including: the efficacy of adopting a feature level of analysis, attending to temporality, using methods suited to each generative mechanism, and combining research approaches.

8.5.1 Feature level of analysis

The ability to draw inferences about qualitatively different patterns of appropriation requires researchers to be more specific about technology (Brinkman et al. 2009; Monteiro & Hanseth 1995), such as through examining the patterns of feature use (Jasperson et al. 2005) and associated work practices. It requires opening up the 'black box' (Kallinikos 2002; Shepherd et al. 2009), something which few studies have done (Jasperson et al. 2005). In this study, data to support feature level analyses were therefore elicited. In the EDMS case, data on the frequency with which documents were stored and managed using electronic and paper-based methods that pre-dated EDMS, as well as for EDMS, assisted in providing a finer grained assessment of the extent of use of EDMS. These data also aided in situating the use of EDMS in context, and surfaced heterogeneous patterns of appropriation across individuals. Similarly, the 'black box' of e-mail was opened up through measuring such things as the number of messages sent on average each day, messages received, messages in the inbox, number of folders, frequency of filing e-mails and frequency of checking e-mails. These measures, combining with data collected at two time points, were pivotal in finding adaptations and stabilisations in patterns of appropriation. They also enabled the concurrency of adaptation

and stabilisation to be identified. Analysis of video data and direct observations were used to identify patterns of feature use for the AKD.

An additional methodological implication of this research is the utility provided by quantitative survey-based measures in teasing out patterns of features use and associated activities or practices. Despite the tendency for IS survey research to provide acontextual accounts of system use, the data from these measures showed that this is not an inherent constraint of this method.

A feature-level of analysis was also an element of one of the measures used to assess user satisfaction with the specific functionality provided by the AKD and the EDMS. For example, one item for the AKD asked how satisfied respondents were with the ability to search for information using the AKD. This customised measure was a significant influence on appropriation intentions or behaviours in both of these cases. The qualitative data from all three cases also identified artefact-specific functionality as an important influence on patterns of appropriation. These findings suggest there is value in researchers similarly developing customised measures of satisfaction with functionality, or eliciting qualitative data on attitudes toward artefact-specific functionality. An added benefit of such measures is the ability to examine responses to particular items, which are related to specific functions, and thereby provide more targeted feedback to developers and implementers.

8.5.2 Attending to temporality

Examining the process of appropriation requires consideration of changes in influences and patterns of appropriation over time. This was achieved through undertaking a cross-case analysis, with each case providing coverage of different sections of the MTA. The process of appropriation was also examined via the length of use measure, as well as the collection of data at two or more data points. Attending to temporality involves more than just a sequence of events or how much exposure people have had to a particular system. It also can involve cycles and rhythms of use (Lee & Liebenau 2000). These additional dimensions have implications for how 'technology in use' or persistent use might be conceptualised and measured. For example, with email, 'technology in use' was characterised by one or more of the following rhythms: responding as messages were received, at set times, and sporadically

or periodically during the day. Consideration of additional temporal dimensions therefore provided a more nuanced view of patterns of appropriation.

Another element of attending to temporality is to situate findings within an historical context. The development of case descriptions in each case involved the collection and elicitation of data that provided an understanding of the historical contexts within which the artefacts of interest were embedded. For example, in the EDMS case, data on document and information management artefacts and practices that pre-dated EDMS were collected. This was achieved through getting participants to reflect on prior systems and practices, such as when undertaking the repertory grid activity. It was also achieved through drawing on reports and studies associated with document and information management within the HQs of interest. Analysis of these data revealed that tangible policy and practice guidance to encourage appropriate document management behaviours was apparent some years prior to the introduction of EDMS, as were concerns about some of the consequences of these behaviours. The system was therefore introduced into an organisation that had developed somewhat ad hoc and individualised practices around document management.

8.5.3 Mapping of motors to features of research design

The capacity to identify the contribution of different generative mechanisms, and the role of contextual features, was facilitated by adopting a research design drawing from qualitative and quantitative IS research traditions. It emerged that particular features of the research design corresponded well with each of the four motors of change (refer Table 8.4).

	Lifecycle	**Teleology**	**Dialectics**	**Evolution**
Method mapping	- Selection of cases that mapped across phases of appropriation process - analysis using time data either cross sectional or longitudinal	- Variance based research approach (ie surveys with rating scale items) informed by cognitive rationale theory	- Use of repertory grid technique - Multi-stakeholder perspective - building a case description (personal, technical and organisational context)	- Use of semi-structured methods, i.e. open to emergent phenomena - longitudinal data collection

Table 8.4 Mapping of motors to features of research design

A lifecycle perspective explains change in terms of a sequence of phases through which the system of interest passes (Van de Ven & Poole 1995). Two features of the research design explicitly support examination of appropriation from this perspective: the selection of cases

and assessment of the temporal aspects of appropriation. The three cases used in this research map across the phases of the appropriation process. The AKD prototype case examines influences and patterns prior to use, and after some initial use. The EDMS case explores continued use (adaptive and stabilised use) by personnel with on average a few months of exposure. The e-mail case examines stabilised and adaptive use by personnel with years of experience. Explicit consideration of the temporal aspects of appropriation was achieved through cross sectional and longitudinal analyses. In the EDMS and E-mail case, the length of time participants had been using the systems was assessed. This information supported the identification of changes in influences over time based on cross sectional data. Longitudinal analyses were supported in all three cases through collecting data at more than one time point.

A teleological perspective frames change as being driven by the purposeful pursuit of goals (Van de Ven & Poole 1995). There is no prescribed sequence. Stakeholders associated with IT artefacts are presumed to be acting as intentional agents. Much of the theory associated with quantitative survey-based research (variance research) can be classed as cognitive rational (Pfeffer 1982). This body of theory frames change in users' dispositions toward technology in the same way; users' beliefs and attitudes inform their intentions which in turn shape their behaviour. The prior identification of influences that might explain users' patterns of appropriation, and changes over time, were drawn from this variance research literature. The surveys employed in this research therefore utilised a variety of variance research measures, such as ease of use, usefulness, and behavioural intention to use.

Dialectic theory explains stability and change by reference to the tension that exists between opposing or contradictory forces, such as that which can exist between designers and users of a system (Van de Ven & Poole 1995). Three aspects of the research design supported exploration of dialectics: a multiple stakeholder perspective, the use of the repertory grid technique, and building case descriptions that included personal, technical and organisational context. In all three cases, data from multiple stakeholder groups was collected. This provided a way of surfacing agreements and tensions between different stakeholders, such as that between open source, advocated by the in-house design team, and COTS, supported by the users, with the AKD prototype case.

The repertory grid technique is designed to identify constructs associated with the objects of interest, called elements. The elements selected in each case provided a way of comparing the

status quo technologies and practices (the thesis), with the new technologies and (potential) practices (the antithesis). For example, in the EDMS case, participants were asked to compare and contrast the following three elements: "previous IM [information management] practices" (thesis), "IM using EDMS" (antithesis), and "Ideal IM practices". If a participant paired "previous IM practices" with "Ideal" versus "IM using EDMS" then the construct associated with this comparison revealed a reason for the thesis retaining importance.

The elements selected and elicited to support the repertory grid process, together with the building of case descriptions that included personal, technical and organisational context, provided a way of identifying the portfolios of systems and practices associated with the core IT artefacts of interest. The presence of portfolios of systems and associated practices, as evidenced in all three cases, represent the resolution or accommodation of tensions between systems and associated practices as they have been incorporated over time (synthesis). For example, e-mail has replaced at least some face-to-face and phone-based communication due to facilitating asynchronous communication. However, it is constrained because it lacks the immediacy and subtleties associated with voice and face-to-face.

Evolutionary theory views change as occurring through a continuous process of variation, selection and retention (Van de Ven & Poole 1995). Variations occur by chance, they are random events. Selection occurs through competition for scarce resources in the environment. Retention refers to maintenance of an entity's form; it serves to counteract the "self-reinforcing loop between variations and selection" (p. 518). An evolutionary perspective therefore captures the tension between change and temporary stabilisations. The use of semi-structured methods in this study provided a means of surfacing random events that influenced or had the potential to influence users' patterns of appropriation and associated portfolios. The contextual information provided by these methods also helped in identifying the ways in which available resources, primarily time, constrained or enabled the survival of entities, here construed as patterns of appropriation and associated portfolios. The consequences of random events identified were explored through retrospection and through data collection at more than one time point.

8.5.4 Combining research approaches

This study used a combination of qualitative and quantitative research approaches in order to develop richer and more complete understanding of the appropriation process. Qualitative methods were used to develop highly contextualised accounts of users' appropriations of particular IT artefacts. Quantitative methods identified what influences were significantly related to various measures of appropriation. They also identified changes in patterns of appropriation over time, such as in the frequency of filing or the number of messages sent. Qualitative and quantitative research approaches were also combined. For example, quantitative data on such things as the number of e-mail messages sent and received was collected at two time points. If substantial changes were identified then interviewees were asked to explain why changes had occurred (see section 6.4.3.2 for a summary of the findings). Many of the insights derived from this research were achieved through combining research approaches, and lend additional support to arguments that combining such approaches provides richer and more holistic understanding than would be yielded by use of an approach in isolation (Van de Ven & Poole 2005).

Whilst combining research approaches clearly has benefits, there are certain research interests and contexts to which it is not well suited. Intensive field studies involving a small number of participants, such as in a small business context, would not provide enough questionnaire responses to allow inferences to be made from statistical analyses. Furthermore, the nature of doing research in organisations is such that gaining access at more than one time point is by no means assured (Buchanan et al. 1988).

8.6 Practical implications

The context within which the Defence organisation operates is often complex and dynamic, as it is in other organisations. This means that organisations must adapt to such contexts in order to maintain effectiveness. One means of achieving this is through modifying or upgrading existing technologies and associated practices, processes and structures. Alternatively, technologies can be purchased that offer the promise of radically new ways of doing business, such as distributed computing and communications infrastructure. In both cases, the enhanced MTA for organisations can serve as a heuristic for guiding the design and selection process for new or upgraded technologies, support the implementation of these technologies, and

assist with the management of the system through its lifespan. It is a model that captures how influences and patterns of appropriation change over time, and the ways in which contextual features influence the trajectory of users as they engaged in the process of appropriation. An understanding of changes in influences and patterns over time can be used to elicit requirements, since users' needs and requirements are articulated as they use a technology to support their work practices (Carroll 2004).

Reflection on the process of technology appropriation also highlights that technologies are shaped by users to support their particular needs. For designers this suggests technologies should be designed for appropriation by making them more malleable and flexible thereby more effectively supporting the behaviour of users (Carroll 2004; Dourish 2003; Hevner et al. 2004). Furthermore, the insights gained can be used to inform the various design activities and practices associated with the context within which the technology is embedded, such as those undertaken by implementers, system integrators, project managers, local management and users. For example, before implementing a new technology, project staff would benefit from identifying those extant IT artefacts and practices that overlap with the proposed technology, as well as examining the ways in which extant artefacts are brought together in portfolios to support work practices. The identification of prior appropriations and technology portfolios would assist in developing change management and implementation plans. This would be consistent with prior research that argues for the importance of understanding users work patterns, models and flows (Agarwal & Prasad 1998; Holtzblatt & Beyer 1993; Holtzblatt & Jones 1993).

The findings from this research confirmed the long observed phenomena of users being shaped by and shaping technology over time, encapsulated in such terms as technology adaptation, re-invention or customisation (Johnson & Rice 1984; Trigg & Bødker 1994; Tyre & Orlikowski 1994). These phenomena are here viewed as part of realising the design of the system through a process of appropriating the technology. Participants did not simply adopt a technology and employ its features in a way that was readily predictable given the material and functional constraints of the technology (the 'technology as designed'). Instead, they were observed to make active choices about how best to employ a particular technology to meet their needs shaped by the functional and performance characteristics of the technology, as well as modifying the technology and their patterns of feature use to suit their aesthetic and work style preferences. This mutual adaptation of practices and technology highlights the

need to consider where the boundaries of IS design should be drawn. Rather than holding to the method driven and analytical distinction between design and implementation, it is here proposed that a designed system continues to be designed as it is implemented, as users appropriate it over time. Design and use, or implementation and innovation, are not separated in space and time (Carroll 2004; Leonard-Barton 1988; Orlikowski 1992). A focus on the process of appropriation provides an alternative answer to the question of "when does [the design] process begin and end?" (Pettigrew 1990, p. 271).

The personal, technical and organisational contexts within which IT artefacts are embedded is likely to be unique, as will be the many ways in which users appropriate artefacts to support their work practices. For example, in the case of the EDMS it was: employed by users who were largely not educated in document management or familiar with the interface, installed on to a network that utilised Lotus Notes for messaging, and which operated in an environment that was much more sensitive than the commercial sector to controlling information access. Furthermore, the process of appropriation through which the EDMS was being incorporated was critically dependent on the evaluations made by users during this process, which in some cases led to partial appropriation. The users played an active role in interpreting, shaping and determining how the EDMS was to be used. The uniqueness of context and the multiple trajectories followed by users when appropriating IT artefacts suggests that resources should be invested in the variety of design and evaluation activities associated with the system, its integration, and ongoing use. Such investments are usually weighted toward design and integration (Davis et al. 1989; Davis & Venkatesh 2004; Jasperson et al. 2005; Marchand 2004). However, a failure to recognise or support the process through which people come to appropriate systems both during and after implementation potentially puts at risk the aspirations of system developers and integrators in achieving desirable changes in organisational behaviour. Furthermore, it limits opportunities to generate additional benefits through understanding the ways in which the capabilities of an artefact can be further exploited by examining influences on rejection and partial appropriations, and introducing interventions designed to enrich use (Jasperson et al. 2005; Lassila & Brancheau 1999).

A common finding across all three cases was the heterogeneity in patterns of appropriation. This is consistent with the view that IT artefacts embody the potential to be adapted (Azad & King 2008; Doherty et al. 2006; Kallinikos 2002; Law & Bijker 1992; MacLean et al. 1990; Orlikowski 1992; Wulf et al. 2005). By recognising this and understanding that adaptation

and heterogeneous patterns of appropriation are normal, those supporting system integration (implementers and management) will be better placed to more effectively guide and shape a process of appropriation that is not simply at the whim of users. There are benefits to be gained from allowing the use of systems to develop in manner that is not prescriptive to the point of stifling creativity. However, a balance needs to be met between providing sufficient procedures to facilitate more efficient utilisation of a system and allowing users enough freedom to generate innovative new ways of using the system to support their work. System integrators have an important role to play in managing this balance, and supporting effective appropriation, informed by a good understanding of the various influences on appropriation in the particular context. The enhanced MTA for organisations may assist integrators in building this understanding by surfacing the various positive and negative influences on users' evaluations of a technology.

Combining qualitative and quantitative research approaches has practical benefits (Ramiller & Pentland 2009). A combined approach minimises the impost on the organisations and the researcher whilst also providing data of sufficient richness to guide the decision making of key organisational stakeholders. Questionnaires can facilitate the efficient collection of both quantitative and qualitative data. Interviews and other qualitative data sources facilitate the development of rich descriptions and explanations. Providing space in the questionnaires for respondents to comment on various aspects of the artefacts of interest is particularly important in reducing some of the data preparation and analysis overhead associated with qualitative data. The collection of data to support examination of patterns of feature use and associated practices also supports the provision of more targeted guidance to developers and implementers.

8.7 A critical analysis of the study

The cases provided overlapping coverage across all of the phases of the appropriation process, and therefore provided coverage across the entire lifecycle of IT use. However, none of these cases provided coverage across all the phases. The AKD case was intended to be such a case but the decision was made not to implement the system.

The number of cases was sufficient to cover all of the phases, however, three cases is relatively small. This could influence the capacity to generalise. However, claims to

generalise were enhanced through comparing the findings against the wider literature and through refining and extending concepts and theories already applied and used in IS research, and referent disciplines.

Balancing parsimony and comprehensiveness is an important challenge for IS researchers since it impacts on the quality of theory and its accessibility for other researchers and IS practitioners (Rosemann & Vessey 2008). The enhanced MTA for organisations incorporates quite a number of concepts and draws on multiple generative mechanisms. Judgements as to the success or otherwise of trying to balance parsimony and comprehensiveness are subjective and therefore dependent on similar theories most familiar to the person making the judgement. A review of the theories considered as potential candidates for explaining the lifecycle of IT use suggests that there are other theories, like the technology acceptance model, that are more parsimonious. However, TAM lacks consideration of the whole lifecycle and is tested via inferential statistics only, therefore necessitating the removal of process, context and history. The enhanced MTA for organisations, by contrast, is a model intended to provide understanding of the appropriation of IT artefacts over time and in context. It therefore requires additional elements. Ultimately the judgement of balance rests with other IS researchers reviewing and applying this model.

The current study adopted a combined qualitative-quantitative research approach, including the use of descriptive statistics, inferential statistics and qualitative analysis. Combining research approaches in this way is potentially problematic, since it is difficult to employ both approaches effectively. Some methodologists might also argue that the research approaches are philosophically incommensurate; that the positivist and interpretivist underpinnings cannot be reconciled. However, the value of doing so is clear, both in terms of combining the strengths of the different approaches, as well as potentially reducing the time impost on participating individuals and organisations.

The selection of measures to assess stabilisation was partly based on the assumption that stabilisation in patterns of appropriation would take a while to emerge, and would therefore by well suited to the e-mail case. This assumption may not be robust, since evidence from prior studies suggests that achieving stability could occur in a matter of weeks or months (Mendoza et al. 2005; Mendoza et al. 2007), or perhaps even hours or days for technologies that have limited malleability. Measures that provide assessments of both adaptation and

stabilisation, such as the nature of IS use and habitual use, should therefore have been included in the EDMS case, and perhaps even the AKD case. Investigation of influences on stabilisation could also be improved. In particular, in comparing patterns of feature use between two time points, an emphasis was placed on getting participants to explain why changes had occurred. To investigate influences on stabilisation, they would also need to be asked why patterns had stayed the same.

Appropriation was conceptualised broadly in this research, and measured in a number of different ways. It is therefore analogous to such concepts as adoption, acceptance and use. Applying appropriation in this way helps to reduce some of the complexity associated with understanding the relationship between users and IT artefacts. However, it runs the risk of being too broad, thereby reducing its descriptive power. This weakness is addressed in a number of ways by:

- clearly specifying and defining the subordinate concepts used to describe different elements or patterns of appropriation;
- identifying the particular measures used to investigate appropriation; and
- situating investigations of appropriation with reference to a particular phase or phases of the IT use lifecycle.

Despite these efforts the risk will remain. In particular, it will remain an ongoing challenge to communicate work in a way that is accessible, but which also is internally consistent with respect to the meaning and boundaries of particular concepts.

8.8 Future research

A goal of future research will be to identify a case where an IT artefact is about to be implemented and then track patterns of appropriation over time, from initial encounters through to 'technology in use', that is, from pre-use through to stabilised use. One element of this case could also include the extant system that is about to be replaced by the new IT artefact. The retirement of a system by an organisation, or the rejection and replacement by users of the system by the new IT artefact, would provide valuable contextual insights. The value of such a case would be in holding constant the IT artefact and use context. Such a case would also support deductive testing of key propositions associated with the enhanced MTA for organisations.

A related goal is to design research in such a way as to further enhance our understanding of the dynamics of influences on and patterns of appropriation over time. This could be done by:

- collecting additional data points for one or more the cases in this research. For example, a third round of interviews could be held with e-mail case participants.
- more frequent investigation of influences and patterns over time
- increasing the sampling frequency through use of system monitoring or shadowing users for some days or months.
- use of simulation models to support the generation and testing of propositions (e.g. Contractor & Seibold 1993).

The quality of the theoretical model developed in this thesis would be further enhanced by refining, developing and testing propositions associated with the new features added to the MTA. Some additional propositions associated with the enhanced MTA include:

- A new technology will become part of a user's technology portfolio if it meets two conditions: it more efficiently or effectively supports his/her practices than an extant technology; and there is sufficient time and opportunity to understand the affordances of the new technology.
- The types of adaptations that occur over time vary. Personalisations will be dominant early in the appropriation process, with customisations and inventions more frequent as users engage in 'technology in use'.
- Usability, usefulness and functionality will cease to be important influences when patterns of appropriation have stabilised.
- The utility of the additional theories of change varies for qualitatively different patterns of use. A teleological motor is most useful during initial encounters, whilst adapting a system and associated practices, or following a contextual influence. A dialectic perspective is most appropriate when the IT artefact of interest is situated in context. The evolutionary viewpoint is suited to understanding why changes in patterns of appropriation occur in contexts where opportunities for active exploration are limited.

Whilst the theoretical model developed in this thesis is intended for organisations, it may be applicable in other contexts. One way of doing this would be to re-examine the data or findings from prior research associated with the MTA to see if the additional concepts and modifications provide additional insights.

The enhanced MTA for organisations does not refer to IS development, except through including the concept of 'technology as designed'. However, the understanding of appropriation provided by the model has clear implications for the design, development and selection of IT artefacts over time. The technology appropriation cycle was developed by Carroll (2004) to explicitly capture the implications of such understanding for the elicitation of requirements and the development of systems that accommodate appropriation. The enhanced MTA for organisation could similarly be extended. A more detailed understanding of the formal design process associated with appropriation would also provide a richer understanding of designers and managers intentions in developing or selecting a particular system, which would therefore enhance understanding of 'technology as designed'.

8.9 Summary

In this chapter influences on and patterns of appropriation over time were considered in the context of the wider literature. Overall, there was reasonable correspondence between the current study and prior research. Consistent with prior research influences varied across phases. Influences also varied over time in terms of their valence or strength. Like previous research, diverse patterns of appropriation were identified including adoption intentions, non-adoption, adoption, adaptations to technology and practices, stabilisation, partial appropriations and embedded appropriations. Patterns also changed over time in both extent and nature.

The above patterns represent the core concepts of the MTA, with the exception of adoption intentions, partial appropriations and embedded appropriations, which were added as part of the development of the enhanced MTA for organisations. Adoption intentions were added to account for the AKD case findings. Partial and embedded appropriations were added as disappropriation (rejection) and appropriation (stabilisation) do not describe the full range of appropriation outcomes. Adaptations were decomposed into technology or practice adaptations. Technology adaptations were further decomposed into personalisations, customisations, inventions and extensions. Mutual adaptations were also identified. Adaptive and stabilised use were not only sequential but also co-existed.

The value of going beyond the use concept to employ appropriation was examined. It was argued that an appropriation perspective adds value through encouraging consideration of the use of IT artefacts in context, and process, including change dynamics and qualitative changes in appropriation patterns over time.

The utility of the MTA as a theoretical model for understanding the IT use lifecycle in organisations was critically evaluated. The MTA was found to address each of four building blocks of theory although areas for improvement were identified. The way the process of appropriation is modelled and described was changed, including: differentiating pre-use and initial use during initial encounters, as well as expanding and redefining 'technology in use' to include both adaptive and stabilised use. The value of incorporating a wider view of context and additional generative mechanisms to create an enhanced MTA for organisations was also considered. Prior appropriations and technology portfolios were two contextual features that provided valuable insights. The additional theories of change and associated generative mechanisms provided enhanced explanatory power through bringing into relief particular aspects of the findings, as well as assisting with explaining the genesis of or transitions between changes.

Finally, the implications of the study methodology for examining technology appropriation were examined including the efficacy of adopting a feature level of analysis, attending to temporality, using methods suited to each generative mechanism, and combining research approaches. Practical implications were also considered, for example the utility of the enhanced MTA as a heuristic device to guide system design, implementation, and ongoing use. A critique of the study identified the absence of a case that covered the entire appropriation process as a shortcoming. The study of such a case was also seen to be an important next step, as was extending the enhanced MTA to more effectively account for the implications of appropriation for formal system design and development.

Glossary

Adaptation	The act or process of modifying (adapted from http://www.merriam-webster.com/dictionary/adaptation). In the case of IT artefacts, it is the act or process of modifying the artefact. Modifications to the technology artefact can include personalisations, customisations and inventions (Desouza et al. 2007). Additional synonyms include reinvention (Johnson & Rice 1984) and tailoring (Trigg & Bødker 1994). Modifications to associated practices are evidenced by changes to work practices, as well as changes in patterns of feature use. Synonyms include workarounds and improvisation (Hayes 1999). Modification to both the artefact and the associated practices is described as mutual adaptation (Carroll 2004). (Also see entries for personalisation, customisation, and patterns of feature use)
Adoption and Non-adoption	Adoption and non-adoption are clearly associated with the initial exposure phase of the MTA (Carroll 2004). Adoption involves a decision to use a technology to support one's practices, and non-adoption when a decision is made to not use the technology.
Amount of use (adapted from Igbaria et al.(1997))	The length of time spent using an IT artefact
Appropriation	See "Technology Appropriation"
Attitude toward computers in general (Clegg et al. 1997)	User's self perceptions of computer literacy
Australian Defence Forces (ADF)	The ADF is composed of the three military services - Royal Australian Navy, Australian Army, Royal Australian Air Force, and a number of tri-service units.
Behavioural intention (Agarwal & Prasad 1998)	Intentions to use a system in the future
Business Support Officer	A temporary appointment funded by the EDMS project to sit down with staff to assist them in using the system in the context of their particular work area and practices. These personnel were embedded in each HQ for a period of some months.
Competence (derived from survey items in scale developed by Clegg et al. (1997))	The ability to use a system adequately (derived from survey items in scale developed by Clegg et al. (1997)). Competence is conceptually similar to self-efficacy, which has been examined by a number of IS researchers(Bhattacherjee et al. 2008; Compeau et al. 1999; Igbaria & Iivari 1995)
Corps	A subdivision or group of military personnel organised according to common activity or occupation. For example, Psychology Corps employs Army psychologist and test administrators.
Customisation (adapted from Desouza et al. (2007))	Customisations entail modifications to the technology to meet functional preferences or requirements, such as hiding or showing particular toolbars.
Defence	Defence includes the ADF, as well as various civilian support organisations.
Defence Science and Technology Organisation (DSTO)	"The Defence Science and Technology Organisation (DSTO) is the Australian government's lead agency charged with applying science and technology to protect and defend Australia and its national interests. DSTO delivers expert, impartial advice and innovative solutions for Defence and other elements of national security." (http://www.dsto.defence.gov.au/page/76/)

Demands on users (Clegg et al. 1997)	The amount of cognitive effort required to use the system.
Disappropriation	Rejection of a technology, such that it is no-longer employed to support a user's practices (Adapted from Carroll (2004)).
Ease of use	"the degree to which a person believes that using a particular system ..[is] free of effort" (Davis 1989, p.320). Tense of original definition changed to present tense from future tense.
Embedded appropriation	Thorough incorporation of an IT artefact with work practices, such that the artefact is a taken for granted part of a user's work life.
Extent of use	(also see entries for amount of use and frequency of use)
Frequency of use	Rate of occurrence of system use, ranging from less than once a month to several times per day (Igbaria et al. 1997). Used as the primary means of assessing the extent of use.
Functionality	"[T]he particular set of functions or capabilities associated with computer software or hardware" (http://www.merriam-webster.com/dictionary/functionality). In the questionnaires functionality was assessed by eliciting user satisfaction with core functionality specific to a particular system.
Future expectations (organisational)	User's expectations that the system would lead to improvements in organisational functioning, such as improved access to information (Clegg et al. 1997).
Generative mechanism	Are the basic or underpinning dynamics that sustain and generate the phenomena of interest (adapted from Contractor and Seibold (1993)). Generative mechanisms explain how and why changes unfold (Van de Ven & Poole 1995).
Habitual use	"refers to the nondeliberate, automatically inculcated response that individuals may bring to IS usage"(Limayem & Hirt 2003, p.66).
Information and Communications Technology (ICT)	Are a subset of information technology which emphasise the role of some IT artefacts in facilitating the processing of information via communication.
Information quality	"the extent to which users believe the information system available to them meets their information requirements" (Ives et al. 1983, p. 785).
Information System (IS)	Is a special case of a work system which is "devoted to processing information, that is, capturing, transmitting, storing, retrieving, manipulating, and displaying information". (Alter 2008, p. 451). A work system is further defined as "a system in which human participants and/or machines perform work (processes, [practices] and activities) using information, technology, and other resources to produce specific products and/or services for specific internal or external customers" (ibid.). Practices were included as part of performing work since they more clearly convey the relationship that exists and evolves between users and IT artefacts in a given work context.
Information Technology (IT)	IT is a particular resource used by people and/or machines to process or assist with processing information. This includes computer systems, software and networks.
IT artefact	Is a special case of an artefact which serves as a resource in support of processing information. An artefact is "something created by humans usually for a practical purpose" (http://www.merriam-webster.com/dictionary/artifact). IT artefacts include computer hardware, software and networks (Alter 2008; Orlikowski & Iacono 2001).

Metadata	"Metadata is structured information that is created specifically to describe another resource. It provides basic information such as the author, the date of creation and the subject matter of the item described. Metadata can be compared to a library catalogue record that facilitates discovery of a particular work by providing information such as title, author, publisher, subject, description of the work, location, etc" (Australian Government Information Management Office 2004: 3).
Nature of use	The qualitatively different patterns of feature use manifested by users of IT artefacts. Nature of use is an umbrella concept covering any descriptions of IT use that go beyond the extent of use, such as adaptation and stabilisation. (Also see entries for adaptation, stabilisation, habitual use, nature of IS use, and patterns of feature use)
Nature of IS use	"the degree to which a person differs from others in the way he or she uses a particular information system" (Jain & Kanungo 2005, p. 115)
Partial appropriation	Limited feature use, or use of work-arounds to minimise use
Patterns of feature use	The particular configuration or set of technology features employed (adapted from Jasperson et al. (2005).
Patterns of appropriation	Includes patterns of feature use, but also includes particular types of practices associated with technology use.
Personalisation	Modifications to the technology to primarily meet a user's aesthetic preferences, such as changing the colour scheme of a user interface (adapted from Desouza et al. (2007)).
Posting cycle	Is the length of time between postings, where a posting is a period of two to three years (usually) during which a Defence member fills an allocated position. In Australia, postings often entail moving interstate.
Prior appropriations	User's previous experience with and patterns of use of the same or similar technologies in a particular use context.
Ranks of the Australian Army	Officer ranks range from Sub-Lieutenant to General with ten increments between them (inclusive), and enlisted members range from Private to Regimental Sergeant Major with 8 increments (inclusive). Refer to http://www.vvaa.org.au/rank.htm and http://www.anzacday.org.au/digging/ranks.html for further details of Army, Navy and Airforce ranks and their equivalences
Signals	A form of electronic messaging specific to Defence communication networks that follows a highly structured and proscribed format so as to minimise bandwidth requirements.
Social mediation	The ways in which a communication channel constrains and enables interpersonal communication (influenced by Trevino et al. (1987)).
Social norms	Rules developed by a group of people that represent beliefs and attitudes about how others should or should not behave. Social norms shape how individuals behave and how they judge the behaviour of others (adapted from www.sociologyguide.com; Venkatesh et al.(2003); Weber (2004)).
Stabilisation	See entries for habitual use and technology appropriation (state)
Standard Operating Procedure	An organisationally sanctioned and proscribed routine for carrying out a particular task.
System design	User satisfaction with the design of the particular artefact and how well it met user needs (Clegg et al. 1997).

Technology Appropriation (verb/process)	Is the process through which technology is evaluated by people over time and adopted, adapted and incorporated into their work practices; and through which the design of technology is completed through use (Carroll et al. 2002a). The MTA describes the process of technology appropriation.
Technology Appropriation (noun)	An instance of technology appropriation, which could include adoption, adaptation or stabilisation.
Technology Appropriation (state)	Is associated with the final phase of the MTA where the practices around the use of the technology become routine or stable, and no further adaptations to the technology occur (adapted from Carroll(2004)).
Technology as Designed	The technology as initially presented to potential users, which embodies an underlying theory or spirit about how an artefact should be employed. This theory or spirit is strongly informed by the intentions of the designer/s (adapted from Carroll (2004) and Carroll et al. (2002a)).
Technology in Use	The technology as it is currently used in the context of routine or stable practices (adapted from Carroll (2004) and Carroll et al. (2002a)). It is synonymous with the state of appropriation or incorporation that defines the final phase of the appropriation process.
Technology Portfolio	A mix of complementary technologies used by a person to support his/her practices (Carroll 2005).
Usability	User satisfaction with the graphical user interface (GUI), navigation, reliability, responsiveness and related issues (adapted from a measure developed by Clegg et al. (1997)). Usability also includes ease of use (see entry for ease of use).
Use (noun)	"the act or practice of employing something", here used as a synonym for usage and utilisation (http://www.merriam-webster.com/dictionary/use).
Use (verb)	"to put into action or service" (http://www.merriam-webster.com/dictionary/use). Here used as synonym for utilise and employ.
Usefulness	"the degree to which a person believes that using a particular system .. enhance[s] his or her job performance" (Davis 1989, p.320). Tense of original definition changed to present tense from future tense.
Voluntariness of use	"the degree to which use of the innovation is perceived as being voluntary, or of free will"(Moore & Benbasat 1991, p. 195)

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Appendices

Understanding information technology appropriation in organisations

Justin James Torneff Fidock

A. Influences on technology use by lifecycle phase (across studies)

Phase	Influences	Outcomes influenced	Type of relationship	*Strength of relationship*
Pre-use	Relative advantage (usefulness) (Agarwal & Prasad 1998)	Intentions to use	+	Strong
	Normative pressures (Karahanna et al. 1999)#1	Intention to adopt	+	Weak
	Perceived usefulness, subjective norm, perceived behavioural control (Taylor & Todd 1995a)#2	Intentions	+ +	Strong Moderate
	Positive expectations about training flexibility (Chu & Robey 2008)#3	Intentions	+	~
	Expectations based on limited understanding of functionality (Carroll et al. 2003)#4	Uncertain about likely effects on lives	~	~
	Subjective norm Relative advantage Easy access Expected usefulness (Mendoza et al. 2005)#5	Decision to adopt	+	~
	Expected usefulness Expected ease of use Subjective norm Need for professionalism Relative advantage (Mendoza et al. 2008)#6	Decision to adopt	+	~
Initial use	Perceived usefulness Perceived ease of use (Davis 1989; Davis et al. 1989)	Intentions to use	+ +	Strong Moderate
	Managerial influence (via incentives and controls) (Bhattacherjee 1998)	Extent of use	+	Moderate
	Attitude toward using technology Performance expectancy (perceived usefulness/extrinsic motivation, relative advantage, outcome expectations, job fit), Effort expectancy (perceived ease of use, ease of use, complexity) Facilitating conditions (perceived behaviour control) Self-efficacy, Anxiety Mandated contexts only: Social influence (subjective norm, social factors, image) (Venkatesh et al. 2003)#7	Intention	+ - +	Strong Strong Moderate Weak-moderate Moderate Weak Moderate
	Expected usefulness, fashion/style, adaptability and familiarity (Carroll et al. 2003)#4 Usefulness, integration with MS word Lack of: adaptability, ease of learning (Mendoza et al. 2005)#5	Adaptations/ customisations Adaptations -changes in research practices - workarounds	+ + -	~ ~
	Usefulness, ease of use and	System use		

Phase	Influences	Outcomes influenced	Type of relationship	*Strength of relationship*
	subjective norm Adaptability (Mendoza et al. 2008)#6	Customisation		
Adaptive use ------	Technical misalignments Delivery system misalignments Value misalignments (usefulness, impact) (Leonard-Barton 1988)	Mutual adaptation	+	~
	Need for flexibility	Personalisation	+	~
	Need for effective/efficient group work practices	Customisation	+	~
	Frustrations with existing artefact/unmet necessities(Desouza et al. 2007)	Inventions	+	~
	Difficulties crossing professional boundaries (misunderstandings, system limitations) Visibility and control (reaffirmation of power relations; resentment of control) (Hayes 1999)	Exception handling, Work-arounds and improvisation		
	Knowledge transfer about system/procedures from other users and IT professionals (Santhanam et al. 2007)	Adapt system to work	+	~
	IS-enabled productivity (like usefulness) (Jain & Kanungo 2005)	Nature of IS use (high scores)	+	Strong
	Discrepant events: -Breakdowns -Introduction of new tech. -Managerial interventions User frustrations (Tyre & Orlikowski 1994)#8	Episodic adaptations (technology/ users knowledge assumptions, procedures, or relationships)	+	~
	Interpretive flexibility	Modify use of technology	+	~
	Perceptions of unreasonable constraints on behaviour (Orlikowski 1992)	Circumvent the tools (workarounds)	-	
	Distributed control, empowerment, participative culture, tool designed to support customisation and app development (Iris)	Modifications to technology (addition/improvement of properties) Heterogeneous technologies-in-practice	+	~
	Application to existing tasks (e.g. memos electronically instead of paper) (Alpha)	-Individual productivity	+	
	Cooperative culture, team incentives, familiarity with computers	-Process support (inc. tech modifications)	+	
	New processes and workarounds for technical support work (Zeta) (Orlikowski 2000)	-Improvisation	+	
	Doubts about value for ind/org performance (not viewed as client focused, training not contextualised, scepticism about technology in general), use of system not	-Limited use (status quo preserved)	-	~

Phase	Influences	Outcomes influenced	Type of relationship	*Strength of relationship*
	billable, competitive culture contrary to information sharing (Zeta) (Orlikowski 2000)			
	Smaller team size (DeSanctis et al. 2000)	Greater team adaptation of the technology	-	Weak
	On-the-job training needed for promotion Learning situated in practice – inconsistent with learning via technology (Chu & Robey 2008)#3	Changes in learning practices – through use of system Ignore and forget system	+ 	~
	Misalignments between existing structures Discrepant events Malleability of structures (Majchrzak et al. 2000)	Changes in org environment and group structures Technology modifications	- - +	~
	Advanced understanding of technology Introduction of PCs (Trigg & Bødker 1994)	Tailoring		
	Functional limitations (e.g no SMS to other networks), limited usability, ease of use and usefulness, hard to learn System functionality (e.g. speaker phone) (Carroll et al. 2003)#4	Disappropriation/ rejection (feature level / whole phone) New social practices	- +	~
	Usefulness Lack of: adaptability, ease of learning, integration (Mendoza et al. 2005)#5	Persistent use Adaptations - workarounds	+ -	~
	Lack of: usefulness, access to help Inability to resolve problems Difficult to learn Gaining experience and confidence Access to help (peers, IT support staff) Attending advanced training (Mendoza et al. 2008)#6	Rejection, limited use Further exploration and adaptation		
Stabilised use	Past use (freq, duration) (Kim et al. 2005)	Usage intention IT use (freq, duration)	+ 	Strong
	IS-enabled productivity (like usefulness) (Jain & Kanungo 2005)	Nature of IS use (low scores)	+	Strong
	Habitual behaviours (Tyre & Orlikowski 1994)#8	Routinisation (of tech and context of use)	+	~
	Low interpretive flexibility influenced by: centralised control mechanisms, standardised work procedures, quite rigid tech design (Orlikowski 1992)	Habitual/routine use	+	~
	Larger team size (DeSanctis et al. 2000)	Development of routines by teams	-	Weak
	Usefulness Lack of: ease of learning, integration (Mendoza et al. 2005)#5	Persistent use Stabilisation?	+ -	~
	Lack of: time, ease of use (Mendoza et al. 2008)#6	No further adaptation		

Phase	Influences	Outcomes influenced	Type of relationship	*Strength of relationship*
Continued use	Perceived consequences (usefulness) Facilitating conditions Social environment Habit, intentions (Limayem & Hirt 2003)	Intentions Extent of use (frequency of access and posting)	+ +	Moderate Moderate
-------	Perceived usefulness Ease of use (Adams et al. 1992)	Extent of use (freq/amount)	+ + and –	Strong Weak
	Perceived usefulness Ease of use (Davis 1989)	Freq of use	+ +	Strong Moderate
	Perceived usefulness Ease of use via usefulness Intention (time 1) Intention (time 2) (Davis et al. 1989)	Intentions to use Extent of use (freq/ amount)	+ + + +	Strong Moderate Moderate Strong
	Age Computer experience; User Training; System quality, Computer Anxiety (Igbaria et al. 1989)	Extent of use (Freq/ amount, no. of apps/ level of sophistication)	- + +	Weak Strong Moderate
	Individual impact (usefulness) (Igbaria & Tan 1997)	Extent of use (no. of apps) User satisfaction (information quality)	+	Strong
	Relative advantage; Attitude; Training; Compatibility; System rating (design) (Al-Gahtani & King 1999)	Extent of use (freq/ amount / no. of apps)	+ + +	Weak Moderate Strong
	Lack of time and user assistance (from colleagues) (Lee 1986)	Extent of use (amount/ no. of apps)	+	Strong
	Training, experience, org support, task structure, attitudes toward computers, (Igbaria 1990)	Extent of use (Freq/ amount, no. of tasks) User satisfaction	+	Strong
	Training, experience, system quality, usefulness Ease of use, org support, (Igbaria et al. 1995)	Extent of use (Freq/ amount, no. of apps / no.of tasks)	+ +	Strong Weak
	Self-efficacy, performance outcome expectations (usefulness), Personal outcome expectations (Compeau et al. 1999)	Extent of use (freq/amount)	+ -	Moderate Weak
	Job fit (usefulness), social factors (org support), Complexity (Thompson et al. 1989)	Extent of use (freq/ amount / no. of apps)	+ -	Strong Moderate
	Computer anxiety, confidence, liking; Usefulness Fun, satisfaction (usability) (Roberts & Henderson 2000)	Extent of use (amount/ no. of apps	- + +	Strong Strong Weak
	Attitude (based on Usefulness (Relative advantage) and image enhancement (Karahanna et al. 1999)#1	Intention to use	+	Strong
	Usefulness, behavioural control Subjective norm	Intentions	+ +	Strong Weak

Phase	Influences	Outcomes influenced	Type of relationship	*Strength of relationship*
	Intentions (Taylor & Todd 1995b)#2	Use of CRC (no. of visits, total time in CRC, no. of projects completed)	+	Strong
	Attitude toward using technology Performance expectancy (perceived usefulness/extrinsic motivation, relative advantage, outcome expectations, job fit) Intention (Venkatesh et al. 2003)#7	Intention Actual use (via system logs)	+ +	Strong Strong
	Job grade Functionality Expectations (self) Use of skills Usability Demands Overall control (Clegg et al. 1997)	Freq & amount Amount Frequency 	- + + + + - +	Strong Moderate Weak Weak Weak Weak Weak
	Perceived usefulness (ns for ease of use) Nil (Straub et al. 1995) IS-enabled productivity (like usefulness) (Jain & Kanungo 2005)	Self reported system use ((sent, received, features used, general) Computer recorded system use (as above) IS use (amount)	+ +	Strong Strong

#n = studies exploring changes in influences and/or patterns of use over time

B. AKD prototype case

B.1. Baseline questionnaires

User case questionnaire

General Instructions: This questionnaire is designed to get your views on the relevance of doctrine in today's Army and to inform the development of the prototype Army Knowledge Portal as part of the Future of Doctrine trial. There are no right or wrong answers. Please read each question or statement carefully.
Today's date:

Age:

Gender:

Highest level of education completed (please select one by inserting a tick ✓)

Less than Year 12	Year 12	TAFE qualification	University undergraduate	University post graduate

Years of Service (eg, 2 years and 5 months): _____

[fp4]What is your current appointment? _____
And, please list your last three appointments

_____ _____ _____

Specific Instructions for Completing the Rating Questions:

Answer the questions by circling the number corresponding to the response that best represents your view. Circle only one number for each question or statement.

To what extent do you agree with the following?

	Strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[D]In general, I am usually nervous about new computer systems. [R]	1	2	3	4	5
[E]In general, I find it hard to learn how to use new computer systems. [R]	1	2	3	4	5
[F]In general, I do not really understand much about computer systems. [R]	1	2	3	4	5
[G]In general, I regard myself as computer-literate.	1	2	3	4	5
[H]In general, I think that computers are just a 'tool' like any other.	1	2	3	4	5

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CW]I can use ADEL well.	1	2	3	4	5
[CX]I sometimes think I am not very competent at using ADEL. [R]	1	2	3	4	5
[CY]I can deal with just about any problem on ADEL.	1	2	3	4	5
[CZ]I find using ADEL quite difficult. [R]	1	2	3	4	5
[DA]I feel I am better than most people at tackling difficulties with ADEL.	1	2	3	4	5
[DB]I use ADEL adequately for what I need to.	1	2	3	4	5

In relation to ADEL, how satisfied are you with the following?

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied	not applicable
[AE]The ability to search for information	1	2	3	4	5	N/A
[AF]The ability to incorporate content from ADEL into other documents	1	2	3	4	5	N/A
[AK]The ability to navigate around	1	2	3	4	5	N/A
[AL]The ability to undertake text searches	1	2	3	4	5	N/A
[AO]The comprehensiveness of information provided by searches	1	2	3	4	5	N/A
[AP]The accessibility of ADEL	1	2	3	4	5	N/A

Comments:

_____

_____

What access do you currently have to a DRN PC? (please select one by inserting a tick ✓)

No access	Limited access (shared with 3 or more personnel)	Shared with only one or two others	Sole user of PC

Generic User

In what contexts have you utilised doctrine in the past? (e.g. prep for upcoming course etc)

_____

_____

Please indicate what formats you have accessed doctrine in the past

Format	*(Please place an ✓ in all the boxes that apply)*	*Please indicate the percentage of time spent utilising the particular format*
Print out from ADEL		
Formal doctrinal publication (hardcopy)		
DEL CD		
Local server		
Intranet		
Other _____		
		%'s should add up to 100%

Please indicate the resources you draw upon to support your professional development

Resources	*(Please place an ✓ in all the boxes that apply)*	*Please indicate the percentage of time spent utilising the particular format*
ADEL		
Centre for Army Lessons website		
nline Campus		
WWW		
Defweb		
Defence library		
Superiors		
Peers/friends		
Subordinates		
Other _____		
		%'s should add up to 100%

Have you accessed ADEL in the last 3 months? (please circle) YES/NO

If YES, how often? IF NO proceed to next question.

Frequency	*(Please place an 'X' in only one of the boxes below)*
Less than once a month	
Once a month	
few times a month	
A few times a week	
About once a day	
Several times per day	

Have you accessed the Centre for Army Lessons website in the last 3 months? (please circle)
YES/NO
If YES, how often? IF NO proceed to next question.

Frequency	*(Please place an 'X' in only one of the boxes below)*
Less than once a month	
Once a month	
few times a month	
A few times a week	
About once a day	
Several times per day	

What is the doctrine hierarchy? (please provide a short description)

_____
_____

What resources (ADEL, WWW, peers, course notes etc) do you draw upon when conducting training at your unit/sub-unit?

_____
_____

What resources have you drawn upon when preparing for and deploying on operations? (please go on to next question if you haven't been deployed)

_____
_____

Do you access/receive current operational reports, observations or lessons from deployments? YES/NO

If YES, how or by what means?

_____
_____

If NO, please proceed to the next question.

What search engine on the WWW are you most comfortable using?

_____

What search engine on the defweb/intranet are you most comfortable using?

_____

Trainee

When using doctrine on course (e.g. via ADEL, hardcopy etc), to what extent:

	Almost never	Some of the time	About half of the time	Most of the time	Almost always
Does it provide the precise information you need?	1	2	3	4	5
Does the information content meet your needs?	1	2	3	4	5
Does it provide sufficient information?	1	2	3	4	5
Are you satisfied with the accuracy of the information?	1	2	3	4	5
Is the information clear?	1	2	3	4	5
Do you think the output is presented in a useful format?	1	2	3	4	5
Is the ADEL system user friendly?	1	2	3	4	5
Is the ADEL system easy to use?	1	2	3	4	5

Comments:

_____

_____

Do you prefer hardcopy or electronic based doctrine when undertaking courses? (please circle one or both) Hardcopy/Electronic
(Please provide an explanation below)

_____

_____

If you were provided with doctrine that was more than 10 years old, what factors would influence your decision whether or not to take notice of the doctrine?

_____

_____

Provide an example of how an instructor has delivered doctrine in a lesson or one on one in a way that enhanced your understanding (e.g. pre-lesson prep, use of personal experience, audio-visual aids etc)

_____

_____

Provide an example of how an instructor has delivered doctrine in a lesson or one on one in a way that undermined your understanding (e.g. pre-lesson prep, use of personal experience, audio-visual aids etc)

_____

_____

	not at all	just a little	a moderate amount	quite a lot	a great deal
How important is doctrine to undertaking the duties of your current appointment	1	2	3	4	5

Pre-Course Package

How do you obtain pre-course information?

_____

When do you complete the PCP? (Please tick all that apply)

During work hours (at work)	After hours at work	During work hours (away from work)	After hours at home

Please indicate how you complete the PCP? (please circle)
Using MS Word/hand written/Other_____(please insert brief description)

PCPs include references that you are required to consult. What are the formats by which you access these references?

Format	*(Please place an ✓ in all the boxes that apply)*
ADEL (intranet, CD etc)	
Print out from ADEL	
Formal doctrinal publication (hardcopy)	
entre for Army Lessons	
WW	
Other _____	

Is the CAL website ever provided as a reference? (please circle) YES/NO

What sort of support do you receive from members (superiors, peers, subordinates) of your unit when completing the PCP?

_____

Instructor/Assessor

(Disregard this section if you have not been either an instructor or an assessor in the Army)
Please indicated how you informed of amendments to doctrine? (please list)

_____ _____

Other than Australian doctrinal publications, what other sources of information do you consult when preparing training material? (please list)

_____ _____

Final comments:

_____

_____

Thankyou for completing this survey.

Baseline questionnaire

General Instructions: This questionnaire is designed to inform the development of the Army Knowledge Domain (AKD) prototype as part of the Future of Doctrine trial. There are no right or wrong answers. Please read each question or statement carefully.

Today's date:

[A]Age:

[B]Gender:

How frequently have you accessed the following information sources in the last 3 months?

Information source	**Frequency of Use** *(place an 'X' in the appropriate box)*					
	Never used (*go to page 4*)	**Less than once a month**	**Once a month**	**A few times a month**	**A few times a week**	**One or more times per day**
[C]**ADEL**						
[D] **Army Knowledge Online** (hosted by Centre for Army Lessons (CAL))						

When did you first start using ADEL? _____(MMM/YY) N/A (if 'N/A' selected go to page 4)

Specific Instructions for Completing the Rating Questions: Answer the questions by circling the number corresponding to the response that best represents your view. Circle only one number for each question or statement.

In relation to ADEL, how satisfied are you with the following?

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied	not applicable
[AE]The ability to search for information	1	2	3	4	5	N/A
[AF]The ability to incorporate content from ADEL into other documents	1	2	3	4	5	N/A
[AK]The ability to navigate around	1	2	3	4	5	N/A
[AO]The comprehensiveness of information provided by searches	1	2	3	4	5	N/A

Comments: (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

How satisfied are you about the following aspects of ADEL:

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied
[BE]Getting into ADEL?	1	2	3	4	5
[BG]Information retrieval?	1	2	3	4	5
[BH]The range of tasks you can do on ADEL?	1	2	3	4	5
[BL]The menu structure?	1	2	3	4	5
[BM]Navigation around ADEL?	1	2	3	4	5
[BN]The reliability of ADEL?	1	2	3	4	5
[BO]System response times?	1	2	3	4	5
[BP]Screen design?	1	2	3	4	5
[BQ]The user interface generally?	1	2	3	4	5
[BR]The ease of learning ADEL?	1	2	3	4	5
[BS]The ease of use?	1	2	3	4	5
[BU]The design of ADEL?	1	2	3	4	5
[BV]ADEL as a whole?	1	2	3	4	5
[BW]I feel as if ADEL was well designed to meet my needs.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

_____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	agree	strongly agree
[CW]I can use ADEL well.	1	2	3	4	5
[DA]I feel I am better than most people at tackling difficulties with ADEL.	1	2	3	4	5
[DB]I use ADEL adequately for what I need to.	1	2	3	4	5

To what extent do you agree with the following?
(Please circle the response options that applies eg: circle either 'ability to learn' or 'job performance')

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CI]ADEL allows me to accomplish tasks more quickly.	1	2	3	4	5
[CJ]Using ADEL improves my: ability to learn / job performance	1	2	3	4	5
[CK]Using ADEL enhances my: learning effectiveness / effectiveness on the job	1	2	3	4	5
[CL]Using ADEL makes it easier to: undertake learning activities / do my job	1	2	3	4	5
[CM]**Overall**, I find ADEL useful in supporting my: learning activities / job.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

_____

When using ADEL to access information to what extent:

	Almost never	Some of the time	About half of the time	Most of the time	Almost always
[DA]Does it provide the precise information you need?	1	2	3	4	5
[DB]Does the information content meet your needs?	1	2	3	4	5
[DC]Does it provide sufficient information?	1	2	3	4	5
[DD]Are you satisfied with the accuracy of the information?	1	2	3	4	5
[DE]Is the information clear?	1	2	3	4	5
[DF]Do you think the output is presented in a useful format?	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

_____

Contextual questions

In what contexts have you utilised doctrine in the past?

_____

_____

_____

Please indicate what formats you have accessed doctrine in the past

Format	*(Please place an ✓ in all the boxes that apply)*	*Please indicate the percentage of time spent utilising the particular format*
Intranet (ADEL Online)		
Print out from ADEL		
Formal doctrinal publication (hardcopy)		
ADEL CD		
Local server		
Other _____		
		%'s should add up to 100%

How important are the following types of information to undertaking the duties of your current appointment?

	not at all	Just a little	a moderate amount	Quite a lot	a great deal
Doctrine	1	2	3	4	5
TTPs	1	2	3	4	5
SOPs	1	2	3	4	5
Observations/lessons from deployments	1	2	3	4	5

Thankyou for completing this questionnaire.

B.2. Feedback on interface designs questionnaire

Interface	**Comments**	**Rank order (1= highest)**
Retina		
Army Knowledge Domain		
Army Knowledge Online (US system)		
Mockup for AKD		
ADEL		
CAL		

B.3. Initial impressions of AKD prototype questionnaire

This questionnaire is designed to inform the development of the Army Knowledge Domain prototype….

Today's date: ……
Age: …… Rank: ……

1. What do you like most about the prototype?

_____
_____
_____
_____

2. What do you like least about the prototype?

_____
_____
_____
_____

3. What could be done to improve the prototype?

_____
_____
_____
_____

4. Any other comments?

_____
_____
_____
_____

B.4. AKD Prototype evaluation questionnaire

General Instructions: This questionnaire is designed to inform the development of the prototype Army Knowledge Domain (AKD) as part of the Future of Doctrine trial. There are no right or wrong answers. Please read each question or statement carefully.

Today's date:

Years of Service (eg, 2 years and 5 months): _____

Highest level of education completed (please select one by inserting a tick ✓)

Less than Year 12	Year 12	TAFE qualification	University undergraduate	University post graduate

What access do you currently have to a DRN PC? (please select one by inserting a tick ✓)

No access	Limited access (shared with 3 or more personnel)	Shared with only one or two others	Sole user of PC

Specific Instructions for Completing the Rating Questions:

Answer the questions by circling the number corresponding to the response that best represents your view. Circle only one number for each question or statement.

To what extent do you agree with the following?

	Strongly disagree	Disagree	neither agree nor disagree	agree	Strongly agree
[D]In general, I am usually nervous about new computer systems. [R]	1	2	3	4	5
[E]In general, I find it hard to learn how to use new computer systems. [R]	1	2	3	4	5
[F]In general, I do not really understand much about computer systems. [R]	1	2	3	4	5
[G]In general, I regard myself as computer-literate.	1	2	3	4	5
[H]In general, I think that computers are just a 'tool' like any other.	1	2	3	4	5

How satisfied are you about the following aspects of the prototype:

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	Very satisfied
BE Getting into the prototype?	1	2	3	4	5
BG Information retrieval?	1	2	3	4	5
BH The range of tasks you can do on the prototype?	1	2	3	4	5
BL The menu structure?	1	2	3	4	5
BM Navigation around the prototype?	1	2	3	4	5
BN The reliability of the prototype?	1	2	3	4	5
BO System response times?	1	2	3	4	5
BP Screen design?	1	2	3	4	5
BQ The user interface generally?	1	2	3	4	5
BR The ease of learning the prototype?	1	2	3	4	5
BS The ease of use?	1	2	3	4	5
BU The design of the prototype?	1	2	3	4	5
BV The prototype as a whole?	1	2	3	4	5
BW I feel as if the prototype was well designed to meet my needs.	1	2	3	4	5

BX Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

When using the prototype, to what extent:

	not at all	just a little	a moderate amount	quite a lot	a great deal
CB Do you have to concentrate all the time when using the prototype?	1	2	3	4	5
CD Do you find your work on the prototype demanding?	1	2	3	4	5
CE Does undertaking a task on the prototype require a great deal of effort?	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

In relation to the prototype, how satisfied are you with the following?

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied	not applicable
[AE]The ability to search for information	1	2	3	4	5	N/A
[AF]The ability to incorporate content from the prototype into other documents	1	2	3	4	5	N/A
[AK]The ability to navigate around	1	2	3	4	5	N/A
[AO]The comprehensiveness of information provided by searches	1	2	3	4	5	N/A
The ability to customise/personalise the prototype	1	2	3	4	5	N/A

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	agree	strongly agree
[CW]I can use the prototype well.	1	2	3	4	5
[CX]I sometimes think I am not very competent at using the prototype. [R]	1	2	3	4	5
[DA]I feel I am better than most people at tackling difficulties with the prototype.	1	2	3	4	5
[DB]I use the prototype adequately for what I need to.	1	2	3	4	5
I intend to use the prototype in the future to support my learning needs	1	2	3	4	5
I intend to use the prototype in the future to access doctrine	1	2	3	4	5
I intend to use the prototype in the future to access lessons	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CI]The prototype allows me to accomplish tasks more quickly.	1	2	3	4	5
[CJ]Using the prototype improves my ability to learn	1	2	3	4	5
[CK]Using the prototype enhances my learning effectiveness	1	2	3	4	5
[CL]Using the prototype makes it easier to undertake learning activities	1	2	3	4	5
[CM]**Overall**, I find the prototype useful in supporting my learning activities.	1	2	3	4	5

My use of the prototype is more sophisticated than others	1	2	3	4	5
I use features in the prototype to do things differently than others.	1	2	3	4	5
I try new features in the prototype to make me more efficient than others.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

Once users are more familiar with using the prototype, I expect that it will lead to:

	strongly disagree	disagree	neither agree nor disagree	Agree	strongly agree
[CO]More efficient course preparation for students.	1	2	3	4	5
[CS]Improved access to information for personnel in this organisation.	1	2	3	4	5
[CT]Improved access to information for other organisations in Defence.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

_____

When using the prototype to access information to what extent:

	Almost never	Some of the time	About half of the time	Most of the time	Almost always
Does it provide the precise information you need?	1	2	3	4	5
Does the information content meet your needs?	1	2	3	4	5
Does it provide sufficient information?	1	2	3	4	5
Are you satisfied with the accuracy of the information?	1	2	3	4	5
Is the information clear?	1	2	3	4	5
Do you think the output is presented in a useful format?	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

_____

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	Agree	strongly agree
The original developers of the prototype would view my use of it as inappropriate.	1	2	3	4	5
I probably use the prototype improperly.	1	2	3	4	5
The developers of the prototype would be disappointed with how I use it.	1	2	3	4	5
I do not believe I use the prototype in the most appropriate fashion.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____

_____

_____

Thankyou for completing this questionnaire.

B.5. Interviews

Interview questions for project team personnel and other stakeholders (30 minutes)

Seed questions include:

1. What has been your role in supporting the Future of Doctrine Trial/Army Knowledge Prototype?
2. What do you believe is the high level rationale for introducing the system?
3. What would be appropriate indicators or metrics for identifying if the rationale has been addressed by the system? (High level measure of success)
4. What metrics could you employ to indicate you have succeeded in performing your role? (measure of success for person's role)
5. What do you believe the system will be used for?
6. Identify some of the positive and negative aspects of the prototype development and testing process
   a. Positives?
   b. Negatives?
   c. What would you do differently next time?
7. Where do you see this project going? Where to next?

Use case development interview questions

Generic User

Q. Please describe for me your understanding of doctrine.
Q. In addition do you see a difference between SOP's and TTP's.
Q. Please describe for me how you manipulate e-Doctrine (ADEL or ADEL CD products) to use in the barracks or field environment.
Q. Please describe for me your attitude towards using Doctrine on operations.
Q. What benefits do you think the Centre for Army Lessons provides Army?
Q. What benefits do you think ADEL provides Army?
Q. If you could change anything about ADEL what would it be?
Q. If you could change anything about the CAL Website what would it be?

Trainee on Course

Q. Can you describe for me how you think you learn best?
Q. What is your general opinion of the doctrine content delivered during training?

Soldier or Officer completing a Pre-Course Package

Q. After completing a PCP do you believe that it will assist in your performance at work?

Instructor/Assessor (I/A) accessing material to support the conduct of training

Q. In what ways do you as the I/A instruct from doctrine publications during Theory, Practical and Assessment periods?
Q. How do you use doctrine to create PCP's for courses you may be instructing on?
Q. How do you prepare information packages based on doctrine for trainees?
Q. How are I/A informed of amendments to doctrine?
Q. How are you informed of the resources available from the CAL Website?
Q. Have you ever utilised information from the CAL Website during periods of instruction?
Q. What is your opinion/attitude towards using Hard Copy Doctrine?
Q. What is your opinion/attitude towards using e-Doctrine?
Q. What is your opinion of ADEL as a tool for instructors?
Q. What is your opinion of the TMP support you receive for courses, in terms of amendments and currency? Do you think Doctrine and should have links to the TMP?

Interview questions for baseline assessment of learning resources and practices (45 minutes)

Contextual Interview (20 minutes)

1. Describe your actions when you use the system/resource to support one or more of these learning activities - pre-course preparation; development of a lesson plan… - and please demonstrate what you mean? This would consider such sub tasks as:
    a. Searching for information
    b. Navigation
    c. Incorporating content from these sources into other documents
    d. Use of the primary aid (eg ADEL) in conjunction with other learning aids/resources (hard copy documents, other trainees/personnel etc)

Repertory Grid Technique (10 minutes)

1. Ask participants to identify the resources they employ to support their learning practices. Note "an ideal knowledge management system" will be included. (This might include such things as ADEL, CAL website, internet, intranet (defweb), Defence library services, superiors, peers/friends, subordinates etc)
2. semi-randomly select three resources for comparison (but in the first selection include ADEL (if identified), and the ideal)
3. repeat step 2 for a different set of resources (but still include ADEL (if identified) and the ideal)
4. repeat until combinations exhausted or time limit reached – this step is unlikely to be required.

Semi-structured questions (15 minutes)

Interviewees who have completed the questionnaire will be invited to clarify or expand on their responses. They will also be asked to provide responses to the following questions.

1. During the next few months would you consider experimenting with or using the prototype to support you work/learning activities?
2. What could be done to improve how electronic and paper based learning resources - such as ADEL, hardcopy doctrinal publications etc – are used within the Army?
3. If you had the power, what three things would you change to improve how people use learning resources in the Army?

B.6. Tasks completed during workshops

Note that some of the material here has been excluded as it is classified.

Task 1: Twenty two questions (question sets 1 and 2)

Question set 1

Question 1. What strategic tasks is the ADF required to undertake in support of Australia's national security objectives?

Question 2. What are the Fundamental Inputs to Capability?

Question 3. What are the eight Battlespace Operating Systems?

Question 4. There are four lines of support. Provide a short description of each.

Question 5. Urban mobile defence exploits what?

Question 6. Armour is employed effectively when?

Question 7. The successful application of manoeuvre theory is underpinned by how many tenets of manoeuvre?

Question 8. During counterinsurgency operations, what are the likely tasks for armour?

Question 9. There are many definitions of leadership. Provide one that would be suitable to use within Army.

..

Question 11. What are some considerations and tips for using an interpreter whilst on operations?

Question 12. Artillery manoeuvre in the advance is influenced by what?

Question 13. The purpose of undertaking support operations is to what?

Question 14. If logistic requirements are to be assessed, what are the four fundamental questions that need to be addressed? (Know as the '4Ds')

Question 15. During offensive operations and whilst in the advance, possible priorities for Ground Based Air Defence may include what?

Question 16. What are some of the cultural considerations that soldiers should be aware of when deploying to the Solomon Islands?

Question 17. Ground analysis, as part of making an assessment of battlespace effects, should follow what acronym?

Question 18. Waste materials in a theatre could be generated by four sources. What are they?

Question 19. Provide a definition for nickname.

Question 20. What is Network Centric Warfare?

Question 21. Access equipment allows soldiers to climb swiftly and effectively, to cross horizontal gaps, to enter and move in underground systems, to climb buildings and bridge obstacles. What special tools may be required access different areas within the urban environment?

Question 22. Why is there a requirement to conduct a Logistic Preparation of the Battlespace?

Question set 2

Question 1. Name the three parts of a cane that would by used for cane drill.

Question 2. What is the philosophy of maintenance support?

Question 3. Nonlethal ammunition may include what?

Question 4. Name six characteristics that will shape the way operations are conducted in urban terrain?

Question 5. Provide a definition for war crime.

..
..
Question 8. Protective operations for infantry involve what?

Question 9. An effective C2 system for armoured operations depends on what?

Question 10. A cordon force is a combined arms grouping made up of what elements?

Question 11. Identify an article/report that supports the use of one of the Principles of War in the MEAO?

Question 12. In brief summary, what is the Chief of Staffs role during the military appreciation process?

Question 13. The Infantry CO employs several means in the execution of their command authority. They are those means:

Question 14. What are the principles of transport support?

Question 15. What is the difference between logistic support and combat service support?

Question 16. Identify some logistic issues encountered by AS forces conducting operations in Timor Leste?

Question 17. The Army has a Management Framework. What is its purpose?

Question 18. What are the five basic urban tactics?

Question 19. Fundamental to any operational planning is consideration of the principles of war and how they apply broadly to the conduct of an operation. What are the 10 principles of war?

Question 20. The success of mission command philosophy is based on a number of prerequisites. What are they?

Question 21. Land force operations are affected by complex terrain in what way?

Question 22. The levels of the ADF's operational capability are determined by analysing what factors?

Task 2: Prepare Powerpoint brief

Option One

You are the platoon commander … Your Coy is in pre-deployment training in preparation to deploy to the Middle East. The OC is very concerned about water management, in particular water conservation whilst on deployment. You have been tasked to provide a 10-15 minute brief using power point to the Coy on 'Tips for conserving water whilst on operations' this Tuesday night at 1830 h.

You have only the computer on your desk to carry out the necessary research and prepare your presentation. IT IS NOW 1730 h.

Option Two

You are the troop commander…. Your squadron is in pre-deployment training in preparation to deploy to the Middle East in order to take over responsibilities from …. The OC needs to ensure that the current training regime covers off against the current tactics being used … for conducting convoys and patrols. You have been tasked to provide a 10-15 minute brief using powerpoint to the Squadron on 'Some of the tactics used … when conducting convoys and patrols' this Tuesday night at 1830 h.

You have only the computer on your desk to carry out the necessary research and prepare your presentation. IT IS NOW 1730 h.

Task 3: Prepare handout on leadership and professional mastery

Your task

As part of the OC's professional development program, you have been tasked to develop a handout for his session on leadership and professional mastery. He has indicated that he will cover the following points:

- What is leadership?
- What are ethos and values?
- What are Army's values?
- Leadership in the Command Environment
- What is professional mastery?
- Linkage between leadership and professional mastery

He has indicated that as part of the handout you must include an overview of the information and any specific diagrams related to that information. The handout only needs to cover off on those points raised by the OC.

You are to collate the information using the following publications available in the publications section of the AKD:

- …
- …
- …

…..

Task 4: Provide feedback to peers on the AKD prototype

You are soon to return to your unit after spending two days evaluating various Army applications. No doubt your peers will ask you about your activities during the two days, and the new Army Knowledge Domain (AKD) that is being developed. For this task you will explore the AKD, its functions and offerings and assess them. For the purposes of this task the AKD does not include Retina. After spending time exploring what the AKD offers, please answer the following questions (you may compare it with the ADEL, CAL, Retina and other Army systems, such as US AKO shown yesterday):

1. Describe the features and functions offered by the AKD

2. We are thinking of replacing the existing search capability within the AKD with Retina. What are you thoughts on this potential change. Please provide specific examples to illustrate you viewpoint. You might find it useful to compare search output produced by the AKD search versus Retina. You might also want to add comments relating to Retina to the questions that follow.

3. Your evaluation of the AKD's 'Look and Feel' (use of colour, blank space, navigation, appropriateness of buttons and tabs etc)

4. How easy to use is the AKD?

5. How useful is the AKD?

6. Will the AKD be valuable for my work?

7. I believe, that if given the opportunity, I would /would not use the AKD in my future work because:

- A
- B
- C
- D
- E

8.a Please circle which of the following sources you use the most: ADEL/ CAL/ paper sources

b. The AKD is more/less useful than the source I use the most because

- A
- B
- C
- D
- E

9. In a perfect world, the AKD would also offer:

- A
- B
- C
- D
- E

B.7. Methods used during workshops

List of methods used

B.2 Feedback on interface designs (2 day only)
B.3 Initial impressions of AKD prototype questionnaire (used in all workshops)
B.1 Baseline questionnaire (all workshops)
B.4 AKD prototype evaluation questionnaire (2 day only)
B.8 Ad hoc feedback (2 day only)
B.9 Group discussions
Group discussion following completion of the Baseline questionnaire (all workshops)
Initial feedback on task 1, question set 1 then set 2, from subgroups (2 day only)
Group discussion on the AKD prototype and implications for learning activities (2 day only)
Group-based administration of repertory grid approach (2 day only)
Feedback on task 3 (90 minute activity only)

a

B.8. Workshop – ad hoc feedback

Date: _____

Note that a sheet like that contained below was provided for each of the tasks undertaken during the scenario based evaluation activities.

Day 1, task 1 – Question set 1	
Positives	Negatives
Suggestions/General comments	

B.9. Group discussions

Group discussion following completion of the Baseline questionnaire

After completing the baseline questionnaire (see Appendix **Error! Reference source not found.**) articipants in the scenario based evaluation activities were invited to share their views and opinions on ADEL with the group. Discussions lasted for approximately 10 to 15 minutes.

Initial feedback on task 1, question set 1 then set 2, from subgroups

Following the conclusion of each of the two sessions devoted to task 1, scenario evaluation participants were invited to provide initial comments and views on the task, and the technology employed to support undertaking the task. Discussions lasted for approximately 3 to 5 minutes.

Group discussion on the AKD prototype and implications for learning activities

Proposed script for explaining group discussion
This group discussion will involve two sets of questions. The first set are traditional semi-structured questions. The second set are based on an approach called Anecdote circles, which are designed to obtain data about your experiences rather than opinions.

Before we begin, let me suggest some things that will make our discussion more productive.
- *Please speak up – only one person should talk at a time and let people finish their story before starting yours.*
- *We are tape recording the session so we don't miss any of your comments. We'll be on a first name basis, and in later reports there will not be any names attached to comments.*
- *You may be assured of anonymity.*
- *My role here is to ask questions and listen. I won't be participating in the conversation but I want you to feel free to talk to one another.*
- *I'll be asking a few major questions and I'll be moving the discussion from one question to the next.*
- *There is a tendency in these discussions for some people to talk a lot and some people not to say much. But is important for us to hear from each of you today because you have different experiences. So if one of you is sharing a lot, I may ask you to let others talk. And if you are not saying much, I may ask for your input.*
- *Whenever you make a statement or provide an opinion we will be interested to hear of an example which illustrates your point.*
- *There are no right of wrong answers and if your experience differs from others in the session please tell us about how it has worked for you.*
- *We want to hear negative and positive responses.*

Participant Guidelines. (write these on a whiteboard before starting the session)
Focus on providing first or second-hand examples
Allow your colleagues to complete their response – no interruptions
Avoid disagreement with another's response, instead tell your own version

Semi-structured question
Script *– you might find it helpful to look at some of the comments and responses you have provided to date.*
- What could be done to improve how electronic and paper based learning resources - such as ADEL, this prototype, hardcopy doctrinal publications etc – are used within the Army?

Anecdote Circle Questions
- People draw on a variety of resources to support them when undertaking learning activities such as other people, ADEL, hard-copy publications and so on. Can you think of a time (prior to this workshop) when one or more resources was particularly helpful in supporting your learning. Conversely can you think of a time when one or more resources was unhelpful or hindered your learning?
- You have had an opportunity to explore and use the Army Knowledge Domain Prototype to support your learning activities. What positive impact/s did the prototype have on how you went

about the tasks? Conversely, what negative impact/s did the prototype have? Please provide an example.

- Learning in an organisation like Army doesn't occur in a vacuum. Army has certain training approaches, structures, processes, practices and culture that influence how you undertake or engage in a particular learning activity. What influences have had a positive impact on your ability to undertake a learning activity. Conversely, what influences have had a negative impact? Please provide an example to illustrate your answer.

Group-based administration of repertory grid approach

The repertory grid technique was used to investigate participants' beliefs and attitudes toward the prototype. This technique was used because it enabled an unstructured comparison of the variety of resources participants employ to support their learning practices. This technique is designed to minimise the influence of researchers when eliciting people's views (Stewart 1997; Whyte & Bytheway 1996). Information about how to use this technique was taken from Stewart (1997).

Participants were firstly asked to identify the resources they employ to support their learning practices and/or role (see table below)(excluding system exposure during workshop). They were then asked to rank order the resources identified based on length of time used. People were then asked to identify similarities and differences between the different means of accessing information. If ADEL was identified as one of their resources, participants were firstly asked to compare ADEL, the Army Knowledge Domain prototype and an ideal knowledge management system. In particular, they were asked: how are two of these systems similar to each other and different from the third?

After having an opportunity to come up with a few comparisons, participants were then asked to substitute the next highest ranked resources for ADEL and again identify how two of the systems are similar to each other and different from the third.

As a group, participants were then invited to share and discuss some of their comparisons.

List of resources employed to support learning practices/role, and rank ordering

	Rank		Rank		Rank
ADEL		Other personnel		Online Campus	
Army Knowledge Online (hosted by CAL)		Intranet site/app_____		Other:	
Defence Library		Internet site/app_____		Other:	

Feedback on task 3

Following the conclusion of task 3 participants in the 90 minute activity were invited to provide comments and views on the task, and the technology employed to support undertaking the task. Discussions lasted for approximately 5 minutes.

B.10. Schedule of activities for workshops

Two day workshop

This activity provided a comprehensive assessment of the AKD prototype in the context of realistic use case scenarios. It also provided an opportunity to collect some baseline data.

Time	**Activity**	**Explanatory notes**
	Day 1	
	Familiarisation and baseline	
10.30	Schedule and administration	
10.40	Evaluation activity overview + ethics	Read the Participant Information Statement and Guidelines for Volunteers If happy to proceed then write your name on the consent form, provide your signature and today's date.
10.50	Introduction and brief on FOD trial	
11.00	System familiarisation	
11.10	Overview of ADEL	Remove the baseline questionnaire from the folder (item 3) Place ID on top left corner.
11.20	Overview of CAL website	
11.30	Baseline questionnaire	
11.45	Group interview	Discussion on questionnaire responses
12.00	Overview of AKD prototype	
12.10	Initial evaluation of AKD	Remove the initial impressions questionnaire from the folder (item 4) Place ID on top left corner. Return questionnaire to folder after completion.
12:15	Feedback on interface designs	Remove the interface designs feedback sheet (item 5) . Place ID on top left corner.
12.30	LUNCH – 1 hour	
	Task 1 – Twenty two questions - individuals	
13.30	Instructions	Ad hoc feedback sheets have been provided for you to write comments on the prototype as you undertake the various tasks. We encourage you to use these. There are 2 pages for each task (item 6).
	(Sub group A) - Stay in current room	
13.40	Question set 1	This group to use current resources (ADEL, CAL website, your memory etc) in answering the 22 questions labelled "Day 1 – Question set 1" (item 7) - Press the record button on CAMSTUDIO when task begins - stop CAMSTUDIO and save as "ref ID"_task1_QS1.
14.45	Initial feedback on task	Comments/issues from completing QS1
14.50	BREAK – 20 minutes	
15.10	Question set 2	Use AKD to answer 22 questions labelled "Day 1 – Question set 2" (item 6) - Press the record button on CAMSTUDIO when task begins - stop CAMSTUDIO and save as "ref ID"_task1_QS2.
16.15	Initial feedback on task	Comments/issues from completing QS2
	(Sub group B) - Move to other room	
13.40	Question set 1	This group to use the AKD in answering the 22 questions labelled "Day 1 – Question set 1" (item 7) - Press the record button on CAMSTUDIO when task begins - stop CAMSTUDIO and save as "ref ID"_task1_QS1.
14.45	Initial feedback on task	Comments/issues from completing QS1
14.50	BREAK – 20 minutes	
15.10	Question set 2	Use current resources (ADEL, CAL website, etc) to answer 22 questions labelled "Day 1 – Question set 2" (item 6) - Press the record button on CAMSTUDIO when task begins - stop CAMSTUDIO and save as "ref ID"_task1_QS2.
16.15	Initial feedback on task	Invite participants to share any comments/issues from completing QS2
16.20	**END OF DAY**	

Day 2		
Task 2 – Prepare PowerPoint brief – individuals		
09.00	Instructions	
	(Sub groups A and B)	
09.10	Prepare brief	use AKD to source information for brief - Press the record button on CAMSTUDIO when task begins – 5 minute break at 0950 - stop CAMSTUDIO and save as "ref ID"_task2.
10.30	BREAK – 15 minutes	
10.45-11.45	Group discussion	Opportunity for participants to share their views on the prototype and reflect on learning practices in the Army
11.45	BREAK – 5 minutes	
Task 3 – Handout on leadership and professional mastery - individuals		
11.50	Instructions	
	(Sub group A and B)	
11.55	Complete task	Use the electronic document titled "Task 3_Handout on leadership and prof mastery.doc" located on desktop (see item 8 for paper copy) - Press the record button on CAMSTUDIO when task begins - stop CAMSTUDIO and save as "ref ID"_task3.
12.25	LUNCH – 1 hour	
Task 4 – Briefing for peers about the systems used during workshop – groups of 2 to 3		
13.30	Instructions	
	(Sub group A&B)	
13.40	Complete task	Use the electronic document titled "TASK 4 - Feedback to peers on AKD.doc" located on desktop (see item 9 for paper copy) - Press the record button on CAMSTUDIO when task begins - stop CAMSTUDIO and save as "ref ID"_task4.
14.25	BREAK – 15 minutes	
14.40	Complete AKD questionnaire	Item 10 in folders. Prototype = Retina + AKD
14:55	Comparison of different systems	Group administration of repertory grid
15:20	Group discussion	Discussion on repertory grid results, final comments, feedback on evaluation approach used
16.00 END OF DAY		

90 minute workshop

This activity provided a means of comparing the AKD prototype XML document viewer against Adobe Acrobat viewer (Version 8). It also provided an opportunity to collect some baseline data.

Time	Description
1100	Overview of Eval activity and ethics
1105	Intro and FOD trial brief
1115	Baseline questionnaire
1130	Group discussion on Q responses
1140	Overview of AKD prototype
1145	Initial eval of AKD prototype
1150	Break (didn't occur)
1155	Explain task: handout on leadership and professional mastery (task 3)
1200	Kick off
1225	Stop/save, then group discussion
1230	Wrap

B.11. Descriptive statistics

AKD

	N	Min	Max	Mean	SD	%>3	%<3
Age	15	21	53.00	34.80	9.30	-	-
Gender	15	1	2.00	1.33	0.49	-	-
Years of service	15	2	33.00	14.81	9.06	-	-
Level of education	15	1.00	4.00	2.20	1.15	-	-
Attitude toward computers	15	2	5.00	3.60	0.83	73	20
Satisfaction with prototype	15	3.20	4.60	3.97	0.36	100	*0*
- search for information	15	3	5	4.33	.617	93	0
- cut and paste	15	3	5	4.60	.632	93	0
- navigation	15	3	5	4.00	.535	87	0
- comprehensiveness of searches	15	3	5	4.13	.516	93	0
- customise/personalise	15	1	4	2.80	.941	27	40
Usability	15	2.78	4.56	3.83	0.49	93	7
Ease of use	15	3.00	5.00	4.23	0.62	93	0
Design	15	2.67	5.00	3.96	0.56	93	7
Usefulness	15	2.40	5.00	4.09	0.86	87	13
Demands on users	15	1.33	4.00	2.29	0.71	13	80
Competence	15	2.25	5.00	3.53	0.67	73	20
Future impact of system	15	4	5.00	4.71	0.50	100	0
Information quality	15	2.83	5.00	4.12	0.59	93	7
Intention to use	15	3.00	5.00	4.42	0.68	93	0
Nature of IS use	15	1.67	4.33	2.96	0.69	33	33
Faithfulness of appropriation	15	1.00	4.50	2.18	0.97	20	73
Correct	15	0	18.00	11.67	4.91	-	-
Incorrect	14	0	7.00	3.71	2.02	-	-
Completed	15	0	25.00	15.13	6.33	-	-

ADEL

	N	Min	Max	Mean	SD	%>3	%<3
Age	51	21	57	36.12	8.71	-	-
Gender	54	1	2	1.26	0.44	-	-
Satisfaction with ADEL							
- search for information	49	1	5	3.47	1.02	59	16
- cut and paste	47	1	5	3.34	1.05	49	19
- navigation	49	1	5	3.29	1.02	49	24
- comprehensiveness of searches	*49*	*1*	*5*	*3.24*	*1.05*	*47*	*18*
Usability	27	2.1	4.6	3.28	0.54	67	33
Ease of use	48	1	5	3.49	0.87	60	17
Design	26	1	5	3.32	0.86	58	19
Usefulness	26	1	5	3.12	0.85	54	23
Competence	48	2	5	3.41	0.62	71	17
ADEL freq	53	1	6	3.74	1.47	-	-
AKO freq	36	1	5	1.83	1.06	-	-
Length of use - ADEL	31	0	11	4.94	3.59	-	-
Info quality	48	1	5	3.62	0.77	77	17

B.12. Correlation matrix

		Alpha	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	**Age**	-	1.00																						
2	**Gender**	-	-0.50	1.00																					
3	**Years of service**	-	0.93**	-0.57*	1.00																				
4	**Level of education**	-	-.71**	0.13	-.70**	1.00																			
5	**Attitude toward computers**	0.68	-0.26	-0.21	-.29	0.34	1.00																		
6	***Satisfaction with prototype***	*0.40*	-0.32	0.05	*-.42*	*0.63**	*-0.16*	*1.00*																	
7	**Usability**	0.80	-0.02	0.36	-.19	0.32	0.02	*0.60**	1.00																
8	**Ease of use**	0.96	-0.02	-0.04	-.15	0.38	0.48	*0.35*	0.55*	1.00															
9	**Design**	0.74	-0.14	0.06	-.15	0.46	0.05	*0.70***	0.79**	0.51	1.00														
10	**Usefulness**	0.94	-0.20	0.33	-.32	0.37	-0.17	*0.63**	0.74**	0.48	0.67**	1.00													
11	**Demands on users**	0.80	0.40	-0.23	.51	-0.48	-0.57*	*-0.10*	-0.27	-0.57*	-0.20	-0.18	1.00												
12	**Competence**	0.80	-0.22	0.18	-.26	0.41	0.47	*0.11*	0.44	0.72**	0.41	0.31	-.75**	1.00											
13	**Future impact of system**	0.97	-0.04	0.42	-.07	0.11	-0.39	*0.37*	0.59*	0.35	0.40	0.74**	0.16	0.28	1.00										
14	**ADEL Freq**	-	-0.40	-0.09	-.35	0.57*	0.31	*0.26*	-0.05	0.20	0.06	-0.04	-.65**	0.45	-0.25	1.00									
15	**Doctrine**	-	0.48	-0.04	.54*	-0.37	-0.10	*-0.38*	-0.01	0.12	0.04	-0.14	0.06	0.15	-0.01	-0.23	1.00								
16	**Years of use**	-	0.69*	-0.66*	.77**	-0.47	-0.05	*-0.44*	-0.41	-0.40	-0.23	-0.61*	0.35	-0.26	-0.48	0.00	0.31	1.00							
17	**Correct**	-	-0.11	-0.10	-.09	0.34	0.13	*0.12*	-0.02	0.12	-0.01	-0.14	0.03	0.21	0.11	0.13	-0.42	0.11	1.00						
18	**Incorrect**	-	0.23	-0.07	.43	-0.29	0.02	*-0.46*	-0.18	-0.42	-0.23	-0.44	0.50	-0.13	0.01	-0.18	0.16	0.52	0.36	1.00					
19	**Completed**	-	0.03	-0.15	.10	0.18	0.10	*-0.02*	-0.09	-0.02	-0.08	-0.28	0.21	0.11	0.07	0.03	-0.28	0.27	0.96**	0.69**	1.00				
20	**Information quality**	0.89	0.00	0.43	-.13	0.05	-0.15	*0.33*	0.75**	0.41	0.46	0.72**	-0.05	0.32	0.83**	-0.26	0.00	-0.38	-0.13	-0.12	-.20	1.00			
21	**Intention to use**	0.85	-0.26	0.40	-.39	0.49	0.05	*0.68**	0.87**	0.51	0.73**	0.83**	-0.25	0.35	0.59*	0.09	-0.06	-0.52	-0.08	-0.21	-.16	.67**	1.00		
22	**Nature of IS use**	0.81	-0.15	0.12	-.01	0.10	-0.43	*0.19*	0.05	-0.31	0.38	0.22	0.30	-0.05	0.21	-0.23	0.31	0.04	-0.18	0.06	-.12	.07	0.11	1.00	
23	**Faithfulness of appropriation**	0.89	0.48	-0.29	.53*	-0.34	-0.79**	*0.08*	-0.24	-0.56*	-0.10	-0.14	0.73**	-.64**	0.02	-0.34	0.23	0.53	-0.07	0.10	0.02	-.15	-.26	0.48	1.00

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

C. EDMS case

C.1. EDMS evaluation questionnaires – initial phase

Questionnaire used in all three HQ

General Instructions:
This questionnaire is designed to evaluate a particular computer system, *EDMS*, from the users' perspective. There are no right or wrong answers. Please read each question or statement carefully.

[A]What is your appointment/position in your organization? _____

[B]When did you first start using EDMS? _____(MMM/YY)

[C]On average, how frequently do you use EDMS for job-related work?

Frequency	*(Please place an 'X' in only one of the boxes below)*
Less than once a month	
Once a month	
A few times a month	
A few times a week	
About once a day	
Several times per day	

Specific Instructions for Completing the Rating Questions:

Answer the questions by circling the number corresponding to the response that best represents your view. Circle only one number for each question or statement.

To what extent do you agree with the following?

	Strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[D]In general, I am usually nervous about new computer systems. [R]	1	2	3	4	5
[E]In general, I find it hard to learn how to use new computer systems. [R]	1	2	3	4	5
[F]In general, I do not really understand much about computer systems. [R]	1	2	3	4	5
[G]In general, I regard myself as computer-literate.	1	2	3	4	5
[H]In general, I think that computers are just a 'tool' like any other.	1	2	3	4	5
[I]EDMS has improved my ability to manage signals	1	2	3	4	5
[J]EDMS has improved the ability of signals to be stored with supporting content	1	2	3	4	5

To what extent do you agree that EDMS has led to improvements in the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree	not applicable
[AA]The ability to store and manage emails	1	2	3	4	5	N/A
[AB]The ability to manage official correspondence	1	2	3	4	5	N/A
[AC]The ability to access the emails of other relevant personnel	1	2	3	4	5	N/A
[AD]The distribution of physical correspondence (via paper and/or electronic copy)	1	2	3	4	5	N/A
[AE]The ability to search for information contained in hardcopy documents	1	2	3	4	5	N/A
[AF]The ability to incorporate content from hardcopy documents into other documents	1	2	3	4	5	N/A
[AG]The ability to share documents within your HQ	1	2	3	4	5	N/A
[AH]Version control of documents	1	2	3	4	5	N/A
[AI]Controlling access to documents	1	2	3	4	5	N/A
[AJ]The ability to retrieve information from across your HQ	1	2	3	4	5	N/A
[AK]The ability to navigate around stored information	1	2	3	4	5	N/A
[AL]The ability to undertake text searches	1	2	3	4	5	N/A
[AM]The ability to manage electronic documents	1	2	3	4	5	N/A
[AN]Intranet document management	1	2	3	4	5	N/A
[AO]The comprehensiveness of information provided by searches	1	2	3	4	5	N/A
[AP]The accessibility of information	1	2	3	4	5	N/A
[AQ]The functionality of correspondence templates (ADFP 102)	1	2	3	4	5	N/A
[AR]Assigning correspondence reference numbers to documents	1	2	3	4	5	N/A

[AS]Comments:

_____

_____

In relation to EDMS, how satisfied are you with the following aspects of training and support:
(Select 'N/A' only if you have not received or used the particular training or support mechanism.)

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied	not applicable
[AT]The formal training you have received?	1	2	3	4	5	N/A
[AU]The support you have received from the help desk?	1	2	3	4	5	N/A
[AV]The help colleagues give you about EDMS?	1	2	3	4	5	N/A
[AW]EDMS documentation (e.g. hard copy or electronic manuals)?	1	2	3	4	5	N/A
[AX]The official on the job training and support you have received? (BSOs)	1	2	3	4	5	N/A

[AY]Comments:

_____

_____

_____

In relation to EDMS, how satisfied are you with the procedures/guidelines provided to support the following activities:
(Select 'N/A' only if you have not used the particular procedures/guidelines)

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied	not applicable
[AZ]The distribution of physical correspondence (via paper and/or electronic copy)?	1	2	3	4	5	N/A
[BA]The sharing of documents?	1	2	3	4	5	N/A
[BB]The transfer of emails into EDMS	1	2	3	4	5	N/A
[BC]The management of emails within EDMS	1	2	3	4	5	N/A
[DD]The retrieval of information from across your HQ	1	2	3	4	5	N/A

[BD]Comments:

_____

_____

How satisfied are you about the following aspects of EDMS:

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied
[BE]Getting into EDMS?	1	2	3	4	5
[BF]Entering data?	1	2	3	4	5
[BG]Data retrieval?	1	2	3	4	5
[BH]The range of tasks you can do on EDMS?	1	2	3	4	5
[BI]The flexibility of EDMS?	1	2	3	4	5
[BJ]Error messages?	1	2	3	4	5
[BK]Online help descriptions?	1	2	3	4	5
[BL]The menu structure?	1	2	3	4	5
[BM]Navigation around EDMS?	1	2	3	4	5
[BN]The reliability of EDMS?	1	2	3	4	5
[BO]System response times?	1	2	3	4	5
[BP]Screen design?	1	2	3	4	5
[BQ]The user interface generally?	1	2	3	4	5
[BR]The ease of learning EDMS?	1	2	3	4	5
[BS]The ease of use?	1	2	3	4	5
[BU]The design of EDMS?	1	2	3	4	5
[BV]EDMS as a whole?	1	2	3	4	5
[BW]I feel as if EDMS was well designed to meet my needs.	1	2	3	4	5

[BX]Comments:

_____

_____

_____

_____

_____

_____

_____

When using EDMS, to what extent:

	not at all	just a little	a moderate amount	quite a lot	a great deal
[BY]Does your work on EDMS demand your undivided attention?	1	2	3	4	5
[BZ]Do you have to keep track of more than one thing at once on EDMS?	1	2	3	4	5
[CA]Do you have to use your memory when using EDMS?	1	2	3	4	5
[CB]Do you have to concentrate all the time when using EDMS?	1	2	3	4	5
[CC]Do you have to react quickly to prevent problems arising when using EDMS?	1	2	3	4	5
[CD]Do you find your work on EDMS demanding?	1	2	3	4	5
[CE]Does undertaking a task on EDMS require a great deal of effort?	1	2	3	4	5
[CF]Do you have to work hard to avoid making errors on EDMS?	1	2	3	4	5
[CG]Do errors that you make on EDMS take a long time to correct?	1	2	3	4	5

[CH]Comments:

_____

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CI]EDMS allows me to accomplish tasks more quickly.	1	2	3	4	5
[CJ]Using EDMS improves my job performance.	1	2	3	4	5
[CK]Using EDMS enhances my effectiveness on the job.	1	2	3	4	5
[CL]Using EDMS makes it easier to do my job.	1	2	3	4	5
[CM]**Overall**, I find EDMS useful in my job.	1	2	3	4	5

[CN]Comments:

_____

_____

Once users are more familiar with using EDMS, I expect that EDMS will lead to:

	strongly disagree	disagree	neither agree nor disagree	Agree	strongly agree
[CO]More efficient processing of work tasks.	1	2	3	4	5
[CP]Greater efficiency in my work group.	1	2	3	4	5
[CQ]Faster throughput of work tasks.	1	2	3	4	5
[CR]Greater productivity in my work group.	1	2	3	4	5
[CS]Improved access to information for staff in this organisation.	1	2	3	4	5
[CT]Improved access to information for other organisations with which you liaise.	1	2	3	4	5
[CU]Better information available for management.	1	2	3	4	5

[CV]Comments:

_____

_____

_____

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CW]I can use EDMS well.	1	2	3	4	5
[CX]I sometimes think I am not very competent at using EDMS. [R]	1	2	3	4	5
[CY]I can deal with just about any problem on EDMS.	1	2	3	4	5
[CZ]I find using EDMS quite difficult. [R]	1	2	3	4	5
[DA]I feel I am better than most people at tackling difficulties with EDMS.	1	2	3	4	5
[DB]I use EDMS adequately for what I need to.	1	2	3	4	5

[DC]Comments:

_____

_____

_____

Questions for personnel supporting information management only

To what extent do you agree that EDMS has led to improvements in the following?

	strongly disagree	Disagree	neither agree nor disagree	agree	strongly agree	not applicable
[EA]The ability to limit access to information with particular codewords/caveats.	1	2	3	4	5	N/A
[EB]The ability to limit access to information to particular people (names, group of names or work group).	1	2	3	4	5	N/A
[EC]The ability to control access to information based on position.	1	2	3	4	5	N/A
[ED]The ability to manage web pages used for information sharing	1	2	3	4	5	N/A
[EE]The structure of data holdings	1	2	3	4	5	N/A

[EF]Has an initial set of EDMS SOPs been provided? YES NO UNSURE

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	agree	strongly agree	not applicable
[EG]The initial set of EDMS SOPs have provided sufficient guidance	1	2	3	4	5	N/A

[EH]Comments:

_____

_____

_____

_____

_____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	Agree	strongly agree	not applicable
[EI]EDMS has led to a reduction in the need to share information via the intranet.	1	2	3	4	5	N/A
[EJ]The EDMS training arrangements have been sufficiently flexible to cope with staff rotations.	1	2	3	4	5	N/A
[EK]Effective support was provided to assist with data migration	1	2	3	4	5	N/A
[EL]The on-site BSOs have assisted in developing and implementing business practices to enhance the effectiveness of EDMS.	1	2	3	4	5	N/A
[EM]Useful guidance has been provided on developing strategies for encouraging staff to use EDMS.	1	2	3	4	5	N/A

[EN]What strategies have been developed to support the management of change associated with EDMS?

List the particular strategies, and in brackets insert a rating indicating the effectiveness of the particular strategies 1 = not at all effective, 5 = very effective. Also, feel free to add comments, and to make suggestions for what could have been done differently.

(examples of strategies might include, establishing specialist roles; communicating the rationale for the change, top management support, the timing of the change etc).

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Questions for Registry personnel only

To what extent do you agree that EDMS has led to improvements in the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree	not applicable
[FA]The management of classified physical correspondence	1	2	3	4	5	N/A
[FB]The management of classified electronic correspondence	1	2	3	4	5	N/A
[FC]The classified document register	1	2	3	4	5	N/A
[FC]The management of physical files	1	2	3	4	5	N/A

[FE]Comments:

_____

_____

_____

_____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	Agree	strongly agree	Not applicable
[FF]The scanning guidelines/SOPs have complemented the implementation of EDMS	1	2	3	4	5	N/A
[FG]The scanning guidelines/SOPs have assisted me in doing my job	1	2	3	4	5	N/A
[FH]The guidelines/SOPs to support physical file management have provided sufficient guidance.	1	2	3	4	5	N/A
[FI]The lotus notes file registers in EDMS can be used effectively.	1	2	3	4	5	N/A

[FK]Comments:

_____

_____

_____

_____

_____

Questions for ISD-SS personnel only

To what extent do you agree that EDMS has led to improvements in the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree	not applicable
[GA]The ability of users to access information when required	1	2	3	4	5	N/A
[GB]System availability	1	2	3	4	5	N/A

[GD]Comments:

_____

_____

_____

_____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	Agree	strongly agree	Not applicable
[GE]The Lotus Notes file registers in EDMS can be used effectively.	1	2	3	4	5	N/A
[GF]The current infrastructure support for EDMS provided by ISD-SS is sufficient	1	2	3	4	5	N/A

[GH]Comments:

_____

_____

_____

_____

Questionnaire used in HQ3 only

This appendix contains the questions used in the HQ3 evaluation questionnaire, and the results obtained. This questionnaire was developed by an Officer in the HQ to address some of the questions posed in the initial evaluation framework document. It was distributed to HQ3 staff in October 2003.

Note: 'Not sure/Not applicable' was also an option but figures weren't provided.

Note: In calculating the percentage of positive (% pos) and negative (% neg) responses it has been assumed that the total number of respondents was 33. This was the highest response total, which was obtained on question 1.

Question	**Yes**	**No**	**% pos**	**% neg**
1. Do you store emails and attachments in EDMS?	12	21	36	64
2. Do you think EDMS has improved information management within this HQ?	10	17	30	52
3. Has EDMS improved the passage of external correspondence around the HQ	11	18	33	55
4. Are you using EDMS to create your documents?	19	12	58	36
5. Does EDMS assist you in the collaborative creation of documents?	11	18	33	55
6. Do you think EDMS assists in document tracking?	17	9	52	27
7. Has EDMS improved document sharing?	13	13	39	39
8. Does the EDMS search tool make finding documents easier?	17	13	52	39
9. Has EDMS improved the management of physical files?	11	12	33	36
10. Are you satisfied with the EDMS security for supporting close hold planning?	13	6	39	18
11. Are you happy with the EDMS document templates?	16	13	48	39
12. Do the EDMS staff provide adequate training and support?	22	5	67	15
13. Does EDMS assist in intranet publishing?	1	15	3	45
14. Do you believe EDMS has improved business practices?	9	17	27	52

15. How do you rate EDMS?	Happy	Satisfied	Necessary Evil	Unsure	Loathe
	1	2	9	2	12

C.2. EDMS evaluation questionnaire – follow-up phase

General Instructions:

This questionnaire is designed to evaluate a particular computer system, *EDMS*, from the users' perspective. There are no right or wrong answers. Please read each question or statement carefully.

[A2]**What is your appointment/position in your organization?**_____

[B2]**When did you first start using EDMS? (MMM/YY)**_____

[HA]**On average, how frequently do you use EDMS to store/manage the following document types?**

Document Type	**Frequency of Use** *(place an 'X' in the appropriate box)*				
	Never used	**Once a week or less**	**A few times a week**	**About once a day**	**Several Times per day**
[A]E-mails					
[B]MS Word					
[C]Excel					
[D]Powerpoint					
[E]Work in progress/drafts					
*_____					
*_____					

*Please add any additional document types/information that you use

[HB]**On average, how frequently do you use your H[1] drive / G drive / mail box to store/manage the following document types?**

Document Type	**Frequency of Use** *(place an 'X' in the appropriate box)*				
	Never used	**Once a week or less**	**A few times a week**	**About once a day**	**Several Times per day**
[A]E-mails					
[B]MS Word					
[C]Excel					
[D]Powerpoint					
[E]Work in progress/drafts					
*_____					
*_____					

[1] H drive = home drive, G drive = group drive.

[HC]**On average, how frequently do you use <u>paper</u> to store/manage the following document types?**

Document Type	**Frequency of Use** *(place an 'X' in the appropriate box)*				
	Never used	**Once a week or less**	**A few times a week**	**About once a day**	**Several Times per day**
[A]E-mails					
[B]MS Word					
[C]Excel					
[D]Powerpoint					
[E]Work in progress/drafts					
*_____					
*_____					

[HD]Comments about document storage/management using EDMS/local storage (H:, G:, Mailbox)/paper:

_____

_____

_____

[HE]**On average, how frequently do you use <u>EDMS</u> to perform the following activities?**

Activity	**Frequency of Use** *(place an 'X' in the appropriate box)*				
	Never used	**Once a week or less**	**A few times a week**	**About once a day**	**Several Times per day**
[A]Collaborative document development					
[B]Search for documents					
[C]Create documents					
[D]Use of correspondence reference numbers to share documents					
[AC2]Access the emails of other personnel					
*_____					
*_____					

*Please add any additional activities that you perform using EDMS

[HF]Comments:

_____

_____

_____

Specific Instructions for Completing the Rating Questions:

Answer the questions by circling the number corresponding to the response that best represents your view. Circle only one number for each question or statement.

To what extent do you agree with the following?

	Strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[G2]In general, I regard myself as computer-literate.	1	2	3	4	5
[CW2]I can use EDMS well.	1	2	3	4	5
[CY2]I can deal with just about any problem on EDMS.	1	2	3	4	5
[DA2]I feel I am better than most people at tackling difficulties with EDMS.	1	2	3	4	5
[DB2]I use EDMS adequately for what I need to.	1	2	3	4	5

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CI2]EDMS allows me to accomplish tasks more quickly.	1	2	3	4	5
[CJ2]Using EDMS improves my job performance.	1	2	3	4	5
[CK2]Using EDMS enhances my effectiveness on the job.	1	2	3	4	5
[CL2]Using EDMS makes it easier to do my job.	1	2	3	4	5
[CM2]**Overall**, I find EDMS useful in my job.	1	2	3	4	5

[CN2]Comments:

_____

_____

_____

_____

To what extent do you agree that EDMS has led to improvements in the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree	not applicable
AA2The ability to store and manage emails	1	2	3	4	5	N/A
AB2The ability to manage official correspondence	1	2	3	4	5	N/A
AD2The distribution of physical correspondence (via paper and/or electronic copy)	1	2	3	4	5	N/A
AG2The ability to share documents within your HQ	1	2	3	4	5	N/A
AH2Version control of documents	1	2	3	4	5	N/A
AI2Controlling access to documents	1	2	3	4	5	N/A
AJ2The ability to retrieve information from across your HQ	1	2	3	4	5	N/A
AK2The ability to navigate around stored information	1	2	3	4	5	N/A
AL2The ability to undertake text searches	1	2	3	4	5	N/A
AM2The ability to manage electronic documents	1	2	3	4	5	N/A
AP2The accessibility of information	1	2	3	4	5	N/A
AR2Assigning correspondence reference numbers to documents	1	2	3	4	5	N/A
HF2Document and information management within the HQ	1	2	3	4	5	N/A

AS2Comments:

_____

_____

_____

_____

_____

In relation to EDMS, how satisfied are you with the following aspects of training and support:
(Select 'N/A' only if you have not received or used the particular training or support mechanism.)

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied	not applicable
AT2The formal training you have received?	1	2	3	4	5	N/A
AU2The support you have received from the help desk?	1	2	3	4	5	N/A
AX2The official on the job training and support you have received? (BSOs)	1	2	3	4	5	N/A

AY2Comments:

_____

_____

How satisfied are you about the following aspects of EDMS:

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	very satisfied
BE2Getting into EDMS?	1	2	3	4	5
BF2Entering data?	1	2	3	4	5
BG2Data retrieval?	1	2	3	4	5
BL2The menu structure?	1	2	3	4	5
BM2Navigation around EDMS?	1	2	3	4	5
BN2The reliability of EDMS?	1	2	3	4	5
BO2System response times?	1	2	3	4	5
BQ2The user interface generally?	1	2	3	4	5
BR2The ease of learning EDMS?	1	2	3	4	5
BS2The ease of use?	1	2	3	4	5
BU2The design of EDMS?	1	2	3	4	5
BV2EDMS as a whole?	1	2	3	4	5
BW2I feel as if EDMS was well designed to meet my needs.	1	2	3	4	5

BX2Comments:

_____

_____

Questions for Registry personnel only

To what extent do you agree that EDMS has led to improvements in the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree	not applicable
FA2The management of classified physical correspondence	1	2	3	4	5	N/A
FB2The management of classified electronic correspondence	1	2	3	4	5	N/A
FC2The classified document register	1	2	3	4	5	N/A
FD2The management of physical files	1	2	3	4	5	N/A

FE2Comments:

_____

_____

_____

_____

_____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	Agree	strongly agree	Not applicable
FF2The scanning guidelines/SOPs have complemented the implementation of EDMS	1	2	3	4	5	N/A
FG2The scanning guidelines/SOPs have assisted me in doing my job	1	2	3	4	5	N/A
FH2The guidelines/SOPs to support physical file management have provided sufficient guidance.	1	2	3	4	5	N/A
FI2The lotus notes file registers in EDMS can be used effectively.	1	2	3	4	5	N/A

FK2Comments:

_____

_____

_____

_____

_____

C.3. Repertory grid interview protocol

Estimated completion time: 10-15 minutes

Things to remember:

- Place your initials at the top of the EDMS REPERTORY GRID QUESTION sheet/handout

Repertory Grid Task

Say: The aim of this question is to evaluate the use of EDMS to support information management. This question utilises an information collection technique called Repertory Grid, which is designed to minimise interviewer bias. We will start with a quick demonstration of the technique.

Before we begin could I get you to place your name, the date and time at the top of this sheet (hand the interviewee the Repertory Grid response sheet/handout)

Action: Place the following three cards in front of the interviewee.

CAR[1]	TRAIN[2]	DONKEY[3]

Say: Can you think of one way in which two of the things represented by these cards are like each other and different from the third?

a) Or

Can you think of something that two of them have in common where the third has something different?

Action: Place the laminated "Example of Repertory Grid Process" in front of interviewee and talk through the examples, including stating the sentence in italics.

Say: You may wish to move the cards in front of you around to aid in making different comparisons.

Action: place CAR next to TRAIN and move DONKEY a greater distance away.

Say: Perhaps I could get you to come up with a couple more. We will give you a few moments to do this on the piece of paper we have supplied, in the "Practice example" part (point to the relevant section of the handout). Write down your answers in the same way as was done on the laminated sheet.

Action: take a note of the format used by the interviewee and correct if necessary.

Once the interviewee has come up with a couple of example constructs confirm his/her understanding of the exercise.

Say: We will now move on to the actual question.

Action: Place the following three cards in front of the interviewee. Please place them in this order.

Previous IM practices [1]	IM using EDMS [2]	Ideal IM practices [3]

Say: Can you think of one way in which two of the things represented by these cards are like each other and different from the third?
b) Or
Can you think of something that two of them have in common where the third has something different?

Write down your answer in the same way as you did for the example.

Note: Get the interviewee to write down his/her answers on the handout supplied.

Action: Check the interviewees understanding of the exercise after they have completed their first comparison by getting them to talk it through. Also ensure they are using the correct formatting. Once you are satisfied they understand ask them:

Say: In your first comparison, can you tell me which workplace you are thinking of for "Previous IM practices"?
Could you please write it down in the space provided underneath "Previous IM practices" on the handout.

Say: I will get you to write down all of your responses on the handout. I will give you about 5 to 10 minutes to work on this task. Please feel free to ask any questions.

Action: Once they have completed the task get the interviewees to talk through the reasons for the various pairings.

c) Say: Now we would like you to talk us through each of your responses

Action: query the interviewee's responses if you are unclear of their meaning, eg, "what do you mean by…?" You could also ask the following question: Can you tell me some more about how x and y are different?" (where x and y are the paired responses.)

C.4. Background and context interviews

Initial phase

Title First Name Lastname, INSERT ROLE
Interviewed by , DDMMMYY, HH:MM

Your role in supporting EDMS

High level rationale for introducing the system

High level MOS – what would be indicators or metrics for identifying if the rationale has been addressed by the system?

MOS for person's role – What metrics could you employ to indicate you have succeeded in performing your role?

Identify some of the positive and negative aspects of the implementation process
Positives

Negatives

Follow-up phase

1) With people I interviewed previously

Briefly review the interview transcript from last time – ask the interviewee to:

- Clarify/expand on any responses
    - Identify any additional positive and negative aspects of the implementation/integration process for EDMS?
    - Identify what they, or their organisation could realistically do to improve the integration process
    - Identify what could be done to improve EDM [Electronic Document Management] and IM [Information Management] in their organisation
    - Identify what the ADO could do to improve the process of implementing systems designed to improve business practice eg EDMS for EDM and IM?
- Reflect on progress since last we spoke for EDMS in relation to:
    - system performance, availability
    - the extent to which EDMS is supporting EDM and IM
    - system interface/intuitiveness
    - training and system support
    - development and enforcement of SOPs, and associated org structure changes (eg IMC network)
    - Interoperability with non-EDMS sites

With new HQ2 system management/support person only

- Provide X with overview of project (completed 03MAR04 am)
- Ask X to describe his/her role in the HQ
- What are his/her plans for supporting EDM/IM in the HQ?
- What knowledge/skills does s/he bring to the job? (background in DMO)
- What is his/her understanding of the process by which technology is introduced into HQ (the implementation process)?
- Undertake rep grid interview

With Information Manager from HQ preparing for EDMS (HQ4)

- Find out how things are going at HQ4 in relation to:
    - Plans for EDMS
    - Education/indoctrination of new staff into HQ IM practices – how effective?
    - What is planned in the next 12 months to support EDM and IM in the HQ?

With HQ2 system management/support person (refer interview with person as part of cohort 1)

- Go through list of questions at 1) above.
- Now that EDMS is moving into long term support phase what is currently in place within HQ2 to support EDM and IM?
- What is planned in the next 12 months to support EDM and IM in the HQ?

With HQ2 system management/support contractor (refer interview with person as part of cohort 1)

- Go through list of questions at 1) above.
- Ask person to identify some lessons s/he has learnt during his/her time as Information Management Coordinator at HQ2.
- Recommendations/Suggestions for future of Information Management in HQ
    - what needs to be done

- what should be retained

With IS support person for HQ2

- Go through list of questions at 1) above – with a particular emphasis on:
  - Accessibility of information
  - System availability and performance
- Adequacy of infrastructure support provided by Corporate IS function:
  - How much of your time is spent supporting EDMS?
  - Who bears the cost of this?
  - What are the risks to a HQ contemplating introducing EDMS from your point of you? Who could provide data on these issues? (To support IM at HQ4s desire to undertake a risk assessment of EDMS)

With DSTO person previously embedded within HQ2

- Ask them to describe the circumstances that led to the report [on information management in HQs 1-3] being produced (who drove it?; who supported it etc)
- What were the critical findings of the report from your point of view? Why?
- What is your understanding of what happened following the production of the report? What influence did the report have? (Mention that the Information Manager at HQ4 utilized this report in support of developing an IM approach at HQ4. S/he was very complementary of the report.)

With EDMS systems integrator representative

- Your role in supporting EDMS
- How did you come to be involved with EDMS?
- What are your plans for supporting EDMS in the next 12 months or so?
- What are some of the positive aspects of the EDMS project from your point of you?
- What are some of the negative aspects of the EDMS project from your point of view?
- What could you, or your organisation realistically do to improve the project?
- What could the ADO (other orgs you interact with/depend on) do to improve the process of implementing systems designed to improve business practice eg EDMS for EDM and IM? (Macro level improve). (Eg project management issues, interactions between key stakeholders etc)

With EDMS vendor representative

- Your role in supporting EDMS
- How did you come to be involved with EDMS?
- What was the genesis of EDMS? (who pushed its introduction, who wanted it etc)
- What are your plans for supporting EDMS in the next 12 months or so? What implications does this have for Defence if any?
- What are some of the positive aspects of the EDMS project from your point of you?
- What are some of the negative aspects of the EDMS project from your point of view?
- What could you, or your organisation realistically do to improve the project?
- What could the ADO (other orgs you interact with/depend on) do to improve the process of implementing systems designed to improve business practice eg EDMS for EDM and IM? (Macro level improve). (Eg project management issues, interactions between key stakeholders etc)
- Go through some of the system centric concerns – eg user interface, people reporting loss of documents etc and explore how these issues are being addressed by Objective.
  - Any thoughts of developing a locked down, cut down, lite version of the client?

- What reporting functionality does the tool have to support system administrators and information managers (eg building a profile of workflow throughout the HQ etc)

With Corporate IS staff – group interview (3 people)

- Provide the attendees with a quick run through of the executive summary + activities for next few weeks
- Briefly review the interview transcript from last time – ask the interviewees to:
    - Clarify/expand on any responses
    - Ask about system availability and performance
    - Identify positive aspects of the implementation/integration process for EDMS
    - Identify negative aspects of the implementation/integration process for EDMS
    - Identify what they, or their organisation could realistically do to improve the integration process
    - Identify what the ADO could do to improve the process of implementing systems designed to improve business practice eg EDMS for EDM and IM?

- Adequacy of infrastructure support provided by Corporate IS function:
    - How much of your time is spent supporting EDMS?
    - Who bears the cost of this?
    - What are the risks to a HQ contemplating introducing EDMS from your point of you? Who could provide data on these issues?

With the EDMS project staff – group interview (2 people)

- Briefly review the interview transcript from last time – ask the interviewee to:
    - Clarify/expand on any responses
    - Ask about system availability and performance
    - Identify positive aspects of the implementation/integration process for EDMS
    - Identify negative aspects of the implementation/integration process for EDMS
    - Identify what they, or their organisation could realistically do to improve the integration process
    - Identify what the ADO could do to improve the process of implementing systems designed to improve business practice eg EDMS for EDM and IM?

C.5. Descriptive statistics

Initial phase

	N	Min	Max	Mean	SD	Skew-ness	Kurt-osis	%>3	%<3
Rank (integer)	47	1	5	2.26	1.31	0.65	-0.81	-	-
Length of use (Months)	46	1	13	6.13	3.46	-0.02	-1.29	-	-
General Attitudes	55	2.60	5.00	3.88	0.65	-0.01	-0.77	87	9
Business Impact	55	1.17	4.72	3.26	0.82	-0.39	0.13	65	35
Support and Training	55	2.60	4.60	3.67	0.51	-0.42	-0.56	80	11
Procedures/guidelines	53	1.00	4.40	3.29	0.75	-0.90	0.34	68	26
Usability	55	1.46	4.46	2.89	0.72	-0.04	-0.97	45	49
Ease of use	55	1.00	5.00	2.60	1.05	0.11	-0.92	27	49
System Design	55	1.00	4.33	2.63	1.08	-0.10	-1.27	35	55
Attention Demands	54	1.40	4.60	3.06	0.73	-0.04	-0.38	52	41
Effort Demands	54	1.00	5.00	2.93	1.10	-0.13	-0.97	44	46
Error Demands	54	1.00	5.00	3.08	1.10	0.09	-0.84	46	43
Usefulness	55	1.00	5.00	2.60	1.19	0.04	-1.32	40	56
Expectations (Org)	55	1.00	5.00	3.13	1.03	-0.23	-0.84	60	40
Competence	55	1.00	5.00	3.11	0.77	0.09	0.71	51	38
Frequency	54	3.00	6.00	5.52	0.95	-1.79	1.82	-	-

Follow-up phase

	N	Min	Max	Mean	SD	Kurt-osis	Skew-ness	%>3	%<3
Rank	26	1.00	5.00	2.19	1.23	0.24	0.99	-	-
Length of use (Months)	28	1.00	16.00	6.18	5.26	-0.95	0.80	-	-
General attitudes (1 item only)	32	3.00	5.00	4.28	0.63	-0.56	-0.30	91	0
Business Impact	31	2.38	5.00	3.83	0.68	0.03	-0.12	90	7
Support and Training	31	1.33	5.00	3.73	0.84	1.01	-0.87	77	16
Usability	31	2.06	4.75	3.43	0.73	-0.64	-0.09	65	29
Ease of use	31	1.00	5.00	3.21	0.99	-0.17	-0.63	58	32
System Design	31	1.67	4.67	3.44	0.80	0.00	-0.89	68	19
Usefulness	32	1.00	5.00	3.23	1.12	-0.41	-0.53	59	28
Competence	32	1.25	5.00	3.32	0.89	0.21	-0.25	63	25
Freq of use – agg. doc types	32	5.00	20.00	11.59	4.19	-0.77	0.18	-	-
No of doc. types	32	1.00	4.00	3.13	1.01	0.21	-1.07	-	-
Freq of use – agg. Activities	32	6.00	24.00	14.23	4.96	-1.07	0.11	-	-
No of activities	32	1.00	5.00	3.66	1.10	-0.39	-0.51	-	-

C.6. Correlation matrices

Initial phase

		(Alpha coeff.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**Location**		1.00														
2	**Rank**		0.41**	1.00													
3	**Length of use (Mths)**		**-0.21**	**-0.16**	1.00												
4	**General Attitudes**	**(0.76)**	0.16	-0.11	**0.19**	1.00											
5	**Business Impact**	**(0.95)**	-0.31*	0.10	**0.50****	0.18	1.00										
6	**Support and Training**	**(0.70)**	-0.38**	-0.04	**0.12**	0.13	0.41**	1.00									
7	**Procedures/guidelines**	**(0.87)**	-0.25	0.13	**0.24**	-0.04	0.66**	0.52**	1.00								
8	**Usability**	**(0.91)**	-0.18	0.21	**0.21**	-0.08	0.60**	0.41**	0.70**	1.00							
9	**Ease of use**	**(0.82)**	-0.33*	0.21	**0.22**	0.08	0.58**	0.48**	0.66**	0.82**	1.00						
10	**System Design**	**(0.93)**	-0.43**	0.10	**0.41**** ***0.35****	-0.03	0.74**	0.47**	0.64**	0.82**	0.83**	1.00					
11	**Demands on users**	**(0.86)**	0.00	-0.20	**-0.20**	-0.30*	-0.49**	-0.20	-0.36**	-0.55**	-0.64**	-0.56**	1.00				
12	**Usefulness**	**(0.96)**	-0.24	0.17	**0.45****	0.07	0.78**	0.26	0.53**	0.64**	0.59**	0.80**	-0.39**	1.00			
13	**Expectations (Org)**	**(0.95)**	-0.27*	0.12	**0.43****	0.06	0.79**	0.26	0.53**	0.55**	0.52**	0.73**	-0.38**	0.86**	1.00		
14	**Competence**	**(0.86)**	-0.26	0.05	**0.27**	0.37**	0.47**	0.33*	0.38**	0.48**	0.55**	0.50**	-0.50**	0.40**	0.32*	1.00	
15	**Frequency of use**		**-0.15**	**0.04**	**0.29***	**0.01**	**0.34***	**0.31***	**0.21**	**0.29*** ***0.27***	**0.29*** ***0.25***	**0.35**** ***0.32****	**-0.12**	**0.37****	**0.34***	**0.44****	1.00

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

_. Change in significance when controlling for location (only flagged for correlations highlighted in bold).

Follow-up phase

		(Alpha coeff.)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	**Location**		1.00														
2	**Rank (integer)**		0.60**	1.00													
3	**Length of use (Months)**		**-0.23**	**0.00**	1.00												
4	**General attitudes (single item)**		0.28	0.12	**-0.12**	1.00											
5	**Business Impact**	**0.93**	-0.04	0.20	**0.18**	0.05	1.00										
6	**Support and Training**	**0.85**	0.18	0.23	**0.09**	-0.18	0.67**	1.00									
7	**Usability**	**0.88**	0.34	0.59**	**-0.13**	-0.15	0.62**	0.59**	1.00								
8	**Ease of use**	**0.88**	0.13	0.32	**0.13**	-0.13	0.66**	0.66**	0.67**	1.00							
9	**System Design**	**0.86**	0.08	0.40*	**0.06**	-0.09	0.76**	0.61**	0.76**	0.79**	1.00						
10	**Usefulness**	**0.97**	-0.14	0.20	**0.18**	-0.09	0.85**	0.63**	0.58**	0.70**	0.76**	1.00					
11	**Competence**	**0.91**	0.02	0.17	**0.42***	0.25	0.68**	0.64**	0.28	0.57**	0.58**	0.64**	1.00				
12	**Freq of use – agg. doc types**		**-0.26**	**0.09**	**0.54****	**0.11**	**0.43***	**0.37***	**0.08**	**0.23**	**0.35** ***0.39****	**0.46** ***0.44****	**0.74****	1.00			
13	**No of doc. types**		**-0.25**	**0.12**	**0.42***	**0.04**	**0.60****	**0.56****	**0.24** ***0.36****	**0.48****	**0.53****	**0.62****	**0.73****	0.76**	1.00		
14	**Freq of use – agg. activities**		**-0.30**	**-0.01**	**0.66****	**-0.25**	**0.43***	**0.35** ***0.43****	**0.09**	**0.25**	**0.32** ***0.36****	**0.42***	**0.56****	0.77**	0.64**	1.00	
15	**No of activities**		**-0.26**	**-0.15**	**0.44***	**-0.09**	**0.39***	**0.33** ***0.40****	**0.11**	**0.20**	**0.32**	**0.40***	**0.45****	0.66**	0.71**	0.69**	1.00

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

_. Change in significance when controlling for location (only flagged for correlations highlighted in bold).

C.7. Storage/management of documents by users employing alternative methods – follow-up phase

Individual level

User	EDMS					Local drive (H drive / G drive / mail box)					Paper				
	E-mails	MS Word	Excel	Power Point	Sum	E-mails	MS Word	Excel	Power Point	Sum	E-mails	MS Word	Excel	Power Point	Sum
1	0	3	0	2	5	0	2	0	2	4	0	0	0	0	0
2	0	2	0	0	2	5	5	5	5	20	4	4	5	3	16
3	4	5	2	2	13	0	0	2	0	2	0	2	0	0	2
4	0	4	3	3	10	5	3	2	2	12	2	2	2	2	8
5	4	5	0	0	9	0	3	2	0	5	0	2	0	0	2
6	5	5	4	4	18	5	4	4	4	17	3	4	2	2	11
7	3	5	5	3	16	5	2	2	2	11	0	0	0	0	0
8	5	2	4	0	11	0	2	3	0	5	2	0	0	0	2
9	0	5	2	4	11	0	5	5	5	15	2	4	4	4	14
10	3	5	2	3	13	2	5	2	3	12	5	5	2	0	12
11	2	3	2	2	9	0	2	0	0	2	3	3	2	2	10
12	5	5	5	5	20	0	2	2	2	6	5	5	5	5	20
13	5	5	2	0	12	5	4	2	2	13	4	3	2	0	9
14	0	5	2	2	9	5	3	2	2	12	0	3	2	0	5
15	2	3	2	0	7	0	2	2	2	6	2	3	2	2	9
16	3	4	2	2	11	2	0	0	0	2	0	0	0	0	0
17	4	4	2	2	12	5	2	2	2	11	2	2	2	0	6
18	0	5	2	3	10	5	3	2	2	12	4	5	2	2	13
19	0	2	0	0	2	0	5	0	0	5	5	5	0	0	10
20	0	3	2	2	7	5	3	2	2	12	0	2	0	0	2
21	0	5	5	5	15	0	2	2	2	6	5	5	5	5	20
22	4	5	5	5	19	4	4	3	4	15	2	2	2	2	8
23	5	5	4	2	16	2	0	0	0	2	0	0	0	0	0
24	2	5	5	2	14	2	5	5	2	14	2	2	2	2	8
25	2	3	2	2	9	2	4	3	2	11	2	3	2	0	7

User	EDMS					Local drive (H drive / G drive / mail box)					Paper				
	E-mails	**MS Word**	**Excel**	**Power Point**	**Sum**	**E-mails**	**MS Word**	**Excel**	**Power Point**	**Sum**	**E-mails**	**MS Word**	**Excel**	**Power Point**	**Sum**
26	0	3	2	0	5	5	3	2	2	12	0	0	0	0	0
27	0	4	2	3	9	5	3	2	2	12	0	2	0	0	2
28	2	3	3	0	8	3	4	4	0	11	0	3	3	0	6
29	0	2	0	0	2	5	4	4	2	15	0	0	0	0	0
30	4	5	5	3	17	5	0	0	0	5	0	3	3	0	6
31	0	3	0	0	3	3	3	0	2	8	3	3	0	0	6
32	2	5	4	4	15	0	3	2	2	7	5	5	2	3	15

Numerical codes for frequency responses were: Never used = 0; Once a week or less = 2; A few times a week =3; About once a day = 4; Several Times per day = 5

Summary

Document Type	Never used	Once a week or less	A few times a week	About once a day	Several Times per day	Total
1) On average, how frequently do you use EDMS to store/manage the following document types?						
E-mails	12	6	3	5	5	31
MS Word	0	4	8	4	16	32
Excel	6	14	2	4	6	32
PowerPoint	9	10	6	3	3	31
2) On average, how frequently do you use your H[1] drive / G drive / mail box to store/manage the following document types?						
E-mails	9	5	2	1	13	30
MS Word	4	8	8	6	5	31
Excel	7	15	3	3	3	31
Powerpoint	9	17	1	2	2	31
3) On average, how frequently do you use paper to store/manage the following document types?						
E-mails	13	8	3	3	4	31
MS Word	7	8	8	3	5	31
Excel	13	12	2	1	3	31
Powerpoint	18	7	1	1	2	29

C.8. Use of EDMS by users to perform a range of activities– follow-up phase

Individual level

User	Collab. Doc. Development	Search for documents	Create documents	Use of Corres. Ref. Numbers	Access the emails of other pers
1	0	2	3	2	0
2	0	2	0	0	0
3	2	5	5	4	2
4	2	5	4	4	0
5	2	5	5	5	0
6	4	5	5	4	2
7	2	5	5	5	0
8	0	5	5	5	0
9	3	3	3	2	0
10	5	5	5	5	4
11	2	4	3	5	2
12	5	5	5	5	0
13	3	5	5	5	2
14	0	4	5	2	0
15	0	3	3	0	0
16	2	3	2	2	0
17	3	2	2	2	2
18	0	4	4	4	0
19	0	3	2	0	0
20	2	3	3	2	0
21	5	5	5	5	0
22	2	3	4	3	2
23	2	5	5	4	0
24	2	5	4	2	0
25	0	3	3	2	0
26	0	3	3	2	0
27	3	5	4	4	0
28	0	3	2	0	0
29	0	2	2	2	0
30	2	5	5	2	3
31	2	3	0	0	0
32	0	5	5	5	0

Summary

Activity	Never used	Once a week or less	A few times a week	About once a day	Several Times per day	Total
Collaborative document development	12	12	4	1	3	32
Search for documents	0	4	10	3	15	32
Create documents	1	5	7	5	13	31
Use of correspondence reference numbers to share documents	5	11	1	5	9	31
Access the emails of other personnel	23	6	1	1	0	31

D. E-mail case

D.1. Preliminary questionnaire

(Administered using SurveyPro V3).

Note that responses are provided where relevant and were selected using radio buttons.

Demographics

1. What gender are you? Male; Female
2. What is your age-group? 18-25; 26-35; 36-45; 45-55; 55+
3. What is your job title? _____
4. How long have you worked at DSTO? Less than 1 year; 1-5 years; 5-10 years; More than 10 years
5. How long have you worked in LOD? Less than 1 year; 1-5 years; 5-10 years; More than 10 years
6. What professional discipline(s) do you affiliate with (e.g. psychology, computer science, engineering)? _____
7. How many staff are you responsible for? (as task manager, supervisor, mission head etc– where more than one of these apply provide highest number) less than 5; 5 to 10; 11 to 15; 16 to 20; more than 20
8. Please rate how experienced you consider yourself with using email?: beginner; intermediate; advanced; expert
9. Have you had formal training in using Email? Yes; No
10. Tell me what you like best about email? _____
11. Tell me what you like least about email? _____

Communication channel choice

12. Remember the last time you initiated communication with someone face to face, what was/were the reason(s) you chose to communicate with the person face to face?
13. Remember the last time you initiated communication with someone using email, what was/were the reason(s) you chose to communicate with the person using email?
14. Remember the last time you initiated communication with someone via a written document, what was/were the reason(s) you chose to communicate with the person via a written document?
15. Remember the last time you initiated communication with someone over the phone, what was/were the reason(s) you chose to communicate with the person over the phone?

16. Remember the last time you received communication from someone, and you chose to respond face to face, what was/were the reason(s) you chose to communicate with the person face to face?

17. Remember the last time you received communication from someone, and you chose to respond using email, what was/were the reason(s) you chose to communicate with the person using email?

18. Remember the last time you received communication from someone, and you chose to respond via a written document, what was/were the reason(s) you chose to communicate with the person via a written document?

19. Remember the last time you received communication from someone, and you chose to respond over the phone, what was/were the reason(s) you chose to communicate with the person over the phone?

Could you participate in further data collection?

D.2. Questionnaire (completed prior to interviews)

General Instructions:

This questionnaire is designed to support a study looking at communications and information management behaviour within LOD with a particular emphasis on email. There are no right or wrong answers. Please read each question or statement carefully.

Today's date:
Gender (please circle): Male/Female

What is your age group? (please circle) 18-25 / 26-35 / 36-45 / 46-55 / 55+

How long have you worked for DSTO?
Less than 1 year / 1 to 5 years / 6 to 10 years / More than 10 years

How long have you worked in LOD?
Less than 1 year / 1 to 5 years / 6 to 10 years / More than 10 years

What is your job title?: _____

What professional discipline(s) do you affiliate with (e.g. psychology, computer science, engineering) _____

How many staff are your responsible for (as a task manager, supervisor, etc. If more than one of these apply provide the highest number).____

How experienced do you consider yourself at using email?
Beginner / Intermediate / Advanced / Expert

Have you had any formal training in using email? Yes/no

What do you like best about email?

_____

_____

_____

What do you like least about email?

_____

_____

_____

Specific Instructions for Completing the Rating Questions:

Answer the questions by circling the number corresponding to the response that best represents your view. Circle only one number for each question or statement.

To what extent do you agree with the following?

	Strongly disagree	Disagree	neither agree nor disagree	agree	Strongly agree
[D]In general, I am usually nervous about new computer systems. [R]	1	2	3	4	5
[E]In general, I find it hard to learn how to use new computer systems. [R]	1	2	3	4	5
[F]In general, I do not really understand much about computer systems. [R]	1	2	3	4	5
[G]In general, I regard myself as computer-literate.	1	2	3	4	5
[H]In general, I think that computers are just a 'tool' like any other.	1	2	3	4	5

When using the email application, to what extent:

	not at all	just a little	a moderate amount	quite a lot	a great deal
[CB]Do you have to concentrate all the time when using the email application?	1	2	3	4	5
[CD]Do you find your work on the email application demanding?	1	2	3	4	5
[CE]Does undertaking a task on the email application require a great deal of effort?	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to): _____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	agree	strongly agree
[CW]I can use the email application well.	1	2	3	4	5
[DA]I feel I am better than most people at tackling difficulties with the email application.	1	2	3	4	5
[DB]I use the email application adequately for what I need to.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to): _____

How satisfied are you about the following aspects of your email application:

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	Very satisfied
[BE]Getting into the email application?	1	2	3	4	5
[BH]The range of tasks you can do on the email application?	1	2	3	4	5
[BL]The menu structure?	1	2	3	4	5
[BM]Navigation around the email application?	1	2	3	4	5
[BN]The reliability of the email application?	1	2	3	4	5
[BO]System response times?	1	2	3	4	5
[BP]Screen design?	1	2	3	4	5
[BQ]The user interface generally?	1	2	3	4	5
[AP]The ability to customise/personalise the email application	1	2	3	4	5
[BR]The ease of learning the email application?	1	2	3	4	5
[BS]The ease of use?	1	2	3	4	5
[BU]The design of the email application?	1	2	3	4	5
[BV]The email application as a whole?	1	2	3	4	5
[BW]I feel as if the email application was well designed to meet my needs.	1	2	3	4	5

[BX]Comments (please highlight using an '*' which aspect/s your comment relates to):
_____
_____
_____
_____

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CI]The email application allows me to accomplish tasks more quickly.	1	2	3	4	5
[CJ] Using the email application improves my job performance.	1	2	3	4	5
[CK]Using the email application enhances my effectiveness on the job	1	2	3	4	5
[CL]Using the email application makes it easier to do my job.	1	2	3	4	5
[CM]**Overall**, I find the email application useful in supporting my job.	1	2	3	4	5
[ED]My use of the email application is more sophisticated than others	1	2	3	4	5
[EE]I use features in the email application to do things differently than others.	1	2	3	4	5
[EF]I try new features in the email application to make me more efficient than others.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):
_____
_____
_____

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	Agree	strongly agree
[EG]The original developers of the email application would view my use of it as inappropriate.	1	2	3	4	5
[EH]I probably use the email application improperly.	1	2	3	4	5
[EI]The developers of the email application would be disappointed with how I use it.	1	2	3	4	5
[EJ]I do not believe I use the email application in the most appropriate fashion.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):
_____
_____

<u>Thankyou for completing this questionnaire.</u>

D.3. Follow-up questionnaire (completed prior to interviews)

General Instructions:

This questionnaire is designed to support a study looking at communications and information management behaviour within LOD with a particular emphasis on email. There are no right or wrong answers. Please read each question or statement carefully.

Today's date:

Gender (please circle): Male/Female

What is your age group? (please circle) 18-25 / 26-35 / 36-45 / 46-55 / 55+

How long have you worked for DSTO?
Less than 1 year / 1 to 5 years / 6 to 10 years / More than 10 years

How long have you worked in LOD?
Less than 1 year / 1 to 5 years / 6 to 10 years / More than 10 years

What is your job title?: _____

What professional discipline(s) do you affiliate with (e.g. psychology, computer science, engineering) _____

How many staff are your responsible for (as a task manager, supervisor, etc. If more than one of these apply provide the highest number._____

How experienced do you consider yourself at using email?
Beginner / Intermediate / Advanced / Expert

Have you had any formal training in using email? Yes/no

When did you first start using e-mail? _____(Year)

What do you like best about email?

_____
_____
_____

What do you like least about email?

_____
_____
_____

Specific Instructions for Completing the Rating Questions:

Answer the questions by circling the number corresponding to the response that best represents your view. Circle only one number for each question or statement.

To what extent do you agree with the following?

	Strongly disagree	Disagree	neither agree nor disagree	agree	Strongly agree
[D]In general, I am usually nervous about new computer systems. [R]	1	2	3	4	5
[E]In general, I find it hard to learn how to use new computer systems. [R]	1	2	3	4	5
[F]In general, I do not really understand much about computer systems. [R]	1	2	3	4	5
[G]In general, I regard myself as computer-literate.	1	2	3	4	5
[H]In general, I think that computers are just a 'tool' like any other.	1	2	3	4	5

When using the email application, to what extent:

	not at all	just a little	a moderate amount	quite a lot	a great deal
[CB]Do you have to concentrate all the time when using the email application?	1	2	3	4	5
[CD]Do you find your work on the email application demanding?	1	2	3	4	5
[CE]Does undertaking a task on the email application require a great deal of effort?	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):

_____
_____
_____

To what extent do you agree with the following?

	strongly disagree	Disagree	neither agree nor disagree	agree	strongly agree
My use of e-mail is voluntary	1	2	3	4	5
[CW]I can use the email application well.	1	2	3	4	5
[DA]I feel I am better than most people at tackling difficulties with the email application.	1	2	3	4	5
[DB]I use the email application adequately for what I need to.	1	2	3	4	5

How satisfied are you about the following aspects of your email application:

	very dissatisfied	dissatisfied	neither satisfied nor dissatisfied	satisfied	Very satisfied
[BE]Getting into the email application?	1	2	3	4	5
[BH]The range of tasks you can do on the email application?	1	2	3	4	5
[BL]The menu structure?	1	2	3	4	5
[BM]Navigation around the email application?	1	2	3	4	5
[BN]The reliability of the email application?	1	2	3	4	5
[BO]System response times?	1	2	3	4	5
[BP]Screen design?	1	2	3	4	5
[BQ]The user interface generally?	1	2	3	4	5
[AP]The ability to customise/personalise the email application	1	2	3	4	5
[BR]The ease of learning the email application?	1	2	3	4	5
[BS]The ease of use?	1	2	3	4	5
[BU]The design of the email application?	1	2	3	4	5
[BV]The email application as a whole?	1	2	3	4	5
[BW]I feel as if the email application was well designed to meet my needs.	1	2	3	4	5

[BX]Comments (please highlight using an '*' which aspect/s your comment relates to):
_____
_____
_____
_____

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	agree	strongly agree
[CI]The email application allows me to accomplish tasks more quickly.	1	2	3	4	5
[CJ] Using the email application improves my job performance.	1	2	3	4	5
[CK]Using the email application enhances my effectiveness on the job	1	2	3	4	5
[CL]Using the email application makes it easier to do my job.	1	2	3	4	5
[CM]**Overall**, I find the email application useful in supporting my job.	1	2	3	4	5
The use of e-mail has become a habit for me	1	2	3	4	5
The use of e-mail has become natural to me	1	2	3	4	5
[ED]My use of the email application is more sophisticated than others	1	2	3	4	5
[EE]I use features in the email application to do things differently than others.	1	2	3	4	5
[EF]I try new features in the email application to make me more efficient than others.	1	2	3	4	5

To what extent do you agree with the following?

	strongly disagree	disagree	neither agree nor disagree	Agree	strongly agree
[EG]The original developers of the email application would view my use of it as inappropriate.	1	2	3	4	5
[EH]I probably use the email application improperly.	1	2	3	4	5
[EI]The developers of the email application would be disappointed with how I use it.	1	2	3	4	5
[EJ]I do not believe I use the email application in the most appropriate fashion.	1	2	3	4	5

Comments (please highlight using an '*' which aspect/s your comment relates to):
_____
_____

Thankyou for completing this questionnaire.

D.4. Interview – preliminary phase

Observable Data and semi-structured questions

01. How many emails would you receive (on average) each day? (Perception)

02. How many emails would you send (on average) each day? (Perception)

03. How many emails in the inbox? [determine from application]

04. How many emails are unopened? [determine from application]

05. Do you file emails?[should be answered by contextual interview]

06. How often do you file emails?

07. How many Folders do you have? [determine from application]

08. How many times a day, on average do you check your emails?

09. When do you do this?

Contextual Interview

Reason for screen configuration

Ask interview to send screen shot

Use of reminders

01. Describe your actions when you check your emails and please demonstrate what you mean?

02. What do you do with emails you have read?

Management of attachments?

Management of important emails?

03. Please describe how you would deal with an unusually large number of emails?

04. What do you use email for?

05. Sorts of rules and resources

Repertory Grid Technique

1. get participants to identify channels they employ.
2. semi-randomly select three channels for comparison (but always include email)
3. repeat step 2 for a different set of channels (but include email)

4. repeat until combinations exhausted or time limit reached.

Repertory Grid –

Rank	Channel	Card number
1	Email	1

Semi-structured questions

09. What could be done to improve how email is used by staff within LOD/DSTO?

10. What could be done to improve the email application (.e.g. Outlook Mail)?

11. What should email be used for?

12. What shouldn't it be used for?

13. What types of email do you receive?

14. Types you like least?

15. Types you like most?

16. Email is like…

17. If you had the power, what three things would you change to improve how people use email in LOD/DSTO?

Any questions or issues re: use of system that we might be able to assist you with?

Summary

D.5. Interview – follow-up phase

Observable Data and semi-structured questions

01. How many emails would you receive (on average) each day? (Perception)

02. How many emails would you send (on average) each day? (Perception)

03. How many emails in the inbox? [determine from application]

04. How many emails are unopened? [determine from application]

05. Do you file emails?[should be answered by contextual interview]

06. How often do you file emails?

07. How many Folders do you have? [determine from application]

08. How many times a day, on average do you check your emails?

09. When do you do this?

Contextual Interview

Reason for screen configuration

Ask interview to send screen shot

Use of reminders

01. Describe your actions when you check your emails and please demonstrate what you mean?

02. What do you do with emails you have read?

Management of attachments?

Management of important emails?

03. Please describe how you would deal with an unusually large number of emails?

04. What do you use email for?

05. Sorts of rules and resources

Semi-structured interview

09. What could be done to improve how email is used by staff within LOD/DSTO?

10. What could be done to improve the email application (.e.g. Outlook Mail)?

~~11. What should email be used for?~~

~~12. What shouldn't it be used for?~~

~~13. What types of email do you receive?~~

~~14. Types you like least?~~

~~15. Types you like most?~~

16. Email is like…

17. If you had the power, what three things would you change to improve how people use email in LOD/DSTO?

18. What could you do to improve how you use e-mail?

19. Since last we spoke on (insert date), have you made any modifications or changed any settings to improve the look/feel/performance of e-mail? (please circle) YES/NO

If so, what ?

And for what reason/s?

20. What other changes have you made to you practices associated with e-mail that we haven't already considered?

For what reason/s did you make the change/s?

Any questions or issues re: use of system that we might be able to assist you with?

Summary

D.6. Types of changes in appropriation patterns for each interviewee

Interviewee ID	**Sent and received**	**Filing behaviour**	**Inbox** size	**Other practices**	**Screen-shot changes**	**E-mail app settings**	**Checking messages**	**No. of changes**
2		Y						1
10	Y	Y		Y	Y			4
11	Y	Y	Y	Y				4
12	Y		Y					2
27	Y							1
28		Y	Y		Y			3
29	Y			Y				2
30	Y	Y	Y		Y		Y	5
31		Y	Y		Y	Y		3
32	Y	Y	Y	Y		Y	Y	6
33	Y	Y		Y	Y	Y		5
34	Y	Y	Y		Y			4
35			Y	Y				2
36	Y	Y	Y	Y	Y			5
38	Y	Y	Y	Y		Y	Y	6
39	Y	Y	Y	Y	Y			5
Total	12	12	11	9	8	4	3	

D.7. Descriptive statistics – follow-up questionnaire

	N	Min	Max	Mean	SD	%>3	%<3
Contextual influences							
Gender	16	1[2]	2	1.31	0.48	-	-
Age	15	1[3]	5	3.13	1.25	-	-
Time at DSTO	16	2	4	3.00	0.89	-	-
Number of Staff Responsible For	16	0	10	1.63	3.14	-	-
Attitude toward computers	16	2	5	3.93	0.77	94	6
Competence	16	2	5	3.69	0.70	88	6
Influences							
Demands on users	16	1	3.67	2.00	0.85	6	81
Voluntariness	16	1	5	2.88	1.20	25	38
Usability	16	3	4.22	3.60	0.40	94	0
Ease of use	16	2	5	3.78	0.73	81	6
Design	16	2	4.67	3.63	0.59	88	6
Usefulness	16	2.60	4.60	3.64	0.61	81	13
Appropriation							
Habitual use	16	2	5	3.78	0.75	75	6
use of e-mail become a habit	16	1	5	3.75	1.06	75	13
Nature of IS use	16	2	3.67	2.69	0.48	19	69
try new features to make me more efficient	16	1	4	2.31	0.70	6	69
Email experience	16	2[4]	3.5	2.50	0.55	-	-
Messages sent	16	2	30	11.94	7.84	-	-
Messages received	16	5	75	23.69	17.05	-	-
Inbox	16	13	13170	2845.81	4136.77	-	-
Folders	15	0	376	87.47	105.59	-	-
Years of use	16	4	21	13.38	5.11	-	-

[2] 1 = male, 2 = female
[3] 1 = 18-25; 2 = 26-35; 3 = 36-45; 4 = 46-55; 5 = 55+
[4] 1 = beginner; 2 = intermediate; 3 = advanced; 4 = expert

D.8. Correlation matrices

Influences with measures of appropriation

		(Alpha coeff)	1	2	3	4	5	6	7	8	9	10	11
1	**Gender**	-	1.00										
2	**Age**	-	0.27	1.00									
3	**Time at DSTO**	-	0.31	.575*	1.00								
4	**No. of Staff**	-	-0.36	0.19	0.45	1.00							
5	**General attitude**	(0.89)	0.00	0.01	0.08	0.25	1.00						
6	**Demands on users**	(0.86)	-.654**	-0.04	0.06	0.43	-0.18	1.00					
7	**Competence**	(0.83)	0.05	0.11	0.04	0.09	.828**	-0.27	1.00				
8	**Usability**	(0.67)	-0.16	-0.12	0.04	-0.15	-0.03	-0.17	0.27	1.00			
9	**Ease of use**	(0.83)	-0.08	-0.35	-0.26	0.11	0.42	-0.18	0.44	0.47	1.00		
10	**Design**	(0.87)	-0.34	-0.30	-0.21	0.12	0.05	0.13	0.20	.691**	.746**	1.00	
11	**Usefulness**	(0.86)	-0.09	-0.11	-0.07	0.01	0.18	-0.47	0.21	0.12	-0.10	-0.16	1.00
12	**Voluntariness**	-	0.42	0.10	-0.19	-0.37	-0.03	-0.48	0.27	0.44	0.23	0.15	0.10
13	**Habitual use**	-	0.03	-0.08	0.21	0.11	-0.24	-0.10	-0.20	0.26	-0.12	0.12	0.39
14	**Nature of IS use**	-	0.28	0.38	0.42	0.18	0.49	-0.37	.658**	0.44	0.14	0.14	0.31
15	**Email experience**	-	0.00	.566*	0.00	0.02	.525*	-0.10	0.49	-0.12	0.04	-0.10	-0.12
16	**Messages sent**	-	-0.01	-0.32	-0.24	0.26	0.21	0.09	0.02	-0.17	0.29	0.25	0.07
17	**Messages received**	-	-0.13	-0.36	-0.45	-0.02	-0.03	-0.01	-0.10	-0.09	0.06	0.24	0.18
18	**Inbox**	-	-0.42	0.17	0.18	0.23	0.09	0.18	0.12	0.48	-0.07	0.14	0.20
19	**Folders**	-	0.43	0.38	0.31	-0.10	0.15	-0.02	0.18	-0.05	0.04	-0.13	-0.25
20	**Years of use**	-	0.17	.559*	.554*	.591*	.638**	0.03	.634**	0.04	0.25	0.13	-0.05

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Intercorrelations amongst the measures of appropriation

		12	13	14	15	16	17	18	19
12	**Voluntariness**	1.00							
13	**Habitual use**	0.13	1.00						
14	**Nature of IS use**	.521*	0.20	1.00					
15	**Email experience**	0.05	-0.34	0.17	1.00				
16	**Messages sent**	0.11	.502*	0.04	-0.12	1.00			
17	**Messages received**	0.06	0.19	0.00	-0.23	.529*	1.00		
18	**Inbox**	0.12	0.26	0.46	-0.03	-0.05	0.02	1.00	
19	**Folders**	0.38	-0.25	0.27	0.15	-0.16	-0.14	-0.27	1.00
20	**Years of use**	0.15	-0.07	.706**	0.42	0.14	-0.19	0.11	0.45

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Intercorrelations of measures of appropriation between time points

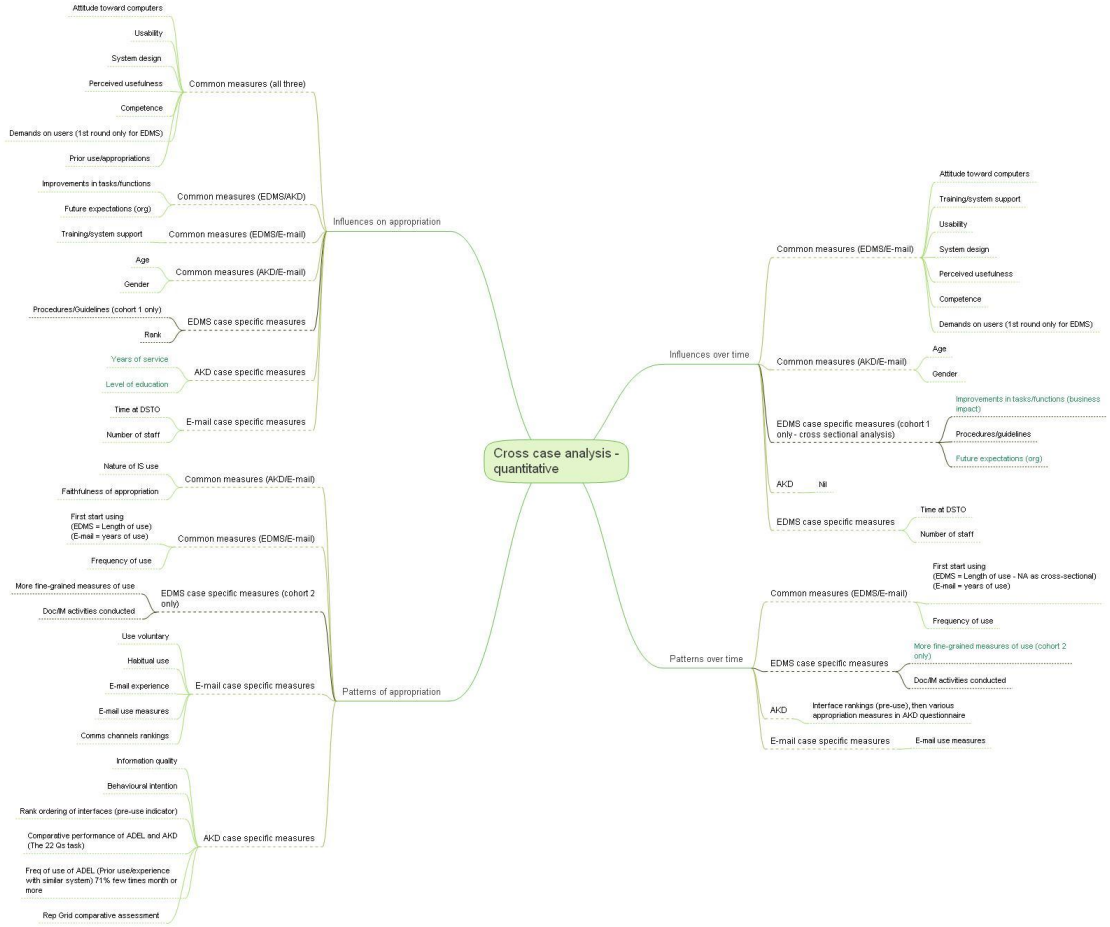
	E-receive_1	E-receive_2	E-sent_1	E-sent_2	E-s+r_1	E-s+r_2	E-inbox_1	E-inbox_2	E-unopen_1	E-unopen_2	Folders_1	Folders_2	Filing_freq_1	Filing_freq_2	I/F ratio_1	I/F ratio_2
E-receive_1	1															
E-receive_2	.069	1														
E-sent_1	.323	.469	1													
E-sent_2	.321	.529*	.941**	1												
E-s+r_1	.955**	.206	.590*	.570*	1											
E-s+r_2	.166	.954**	.692**	.759**	.359	1										
E-inbox_1	.109	-.118	-.230	-.192	.021	-.159	1									
E-inbox_2	.196	.016	-.083	-.049	.141	-.005	.782**	1								
E-unopened_1	.544*	-.188	-.252	-.181	.385	-.208	.679**	.331	1							
E-unopened_2	.414	-.195	-.269	-.183	.269	-.214	.781**	.436	.972**	1						
Folders_1	.182	-.257	-.149	-.172	.109	-.258	-.103	-.279	.228	.147	1					
Folders_2	.071	-.138	-.122	-.158	.022	-.162	-.110	-.274	.122	.049	.971**	1				
Filing_freq_1	.021	-.208	.101	.087	.049	-.129	-.300	-.506*	-.029	-.084	.549*	.542*	1			
Filing_freq_2	.063	-.113	.070	.051	.075	-.069	.112	-.209	.309	.285	.459	.457	.814**	1		
I/F ratio_1	-.273	.590*	-.169	-.122	-.286	.414	.119	.149	-.127	-.095	-.414	-.312	-.624*	-.387	1	
I/F ratio_2	-.010	-.096	-.137	-.113	-.052	-.114	.003	.336	-.172	-.141	-.360	-.353	-.586*	-.595*	.425	1

E. Analysis maps

The maps produced included details of particular findings for each influence and pattern. However, in the interests of space only the first three levels of each map are provided.

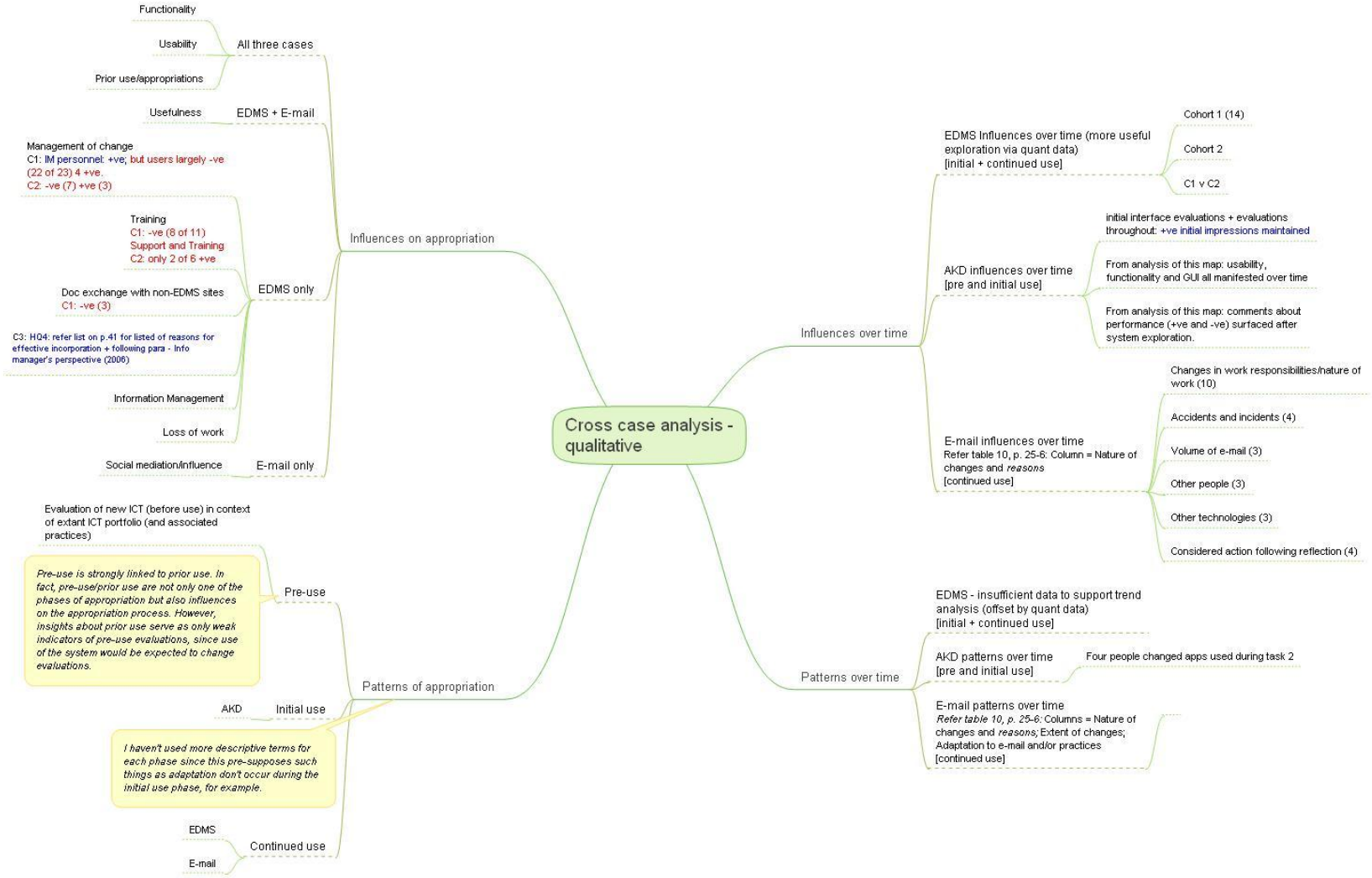
E.1. Quantitative results

Cross-case



E.2. Qualitative results

Cross-case



F. List of peer reviewed publications associated with PhD

Fidock, J., & Carroll, J. (2011) *Why do users employ the same system in so many different ways?* (invited paper: accepted for publication), IEEE Intelligent Systems, Special issue: social computing and cultural modelling.

Carroll, J., & Fidock, J. (2011) *Beyond resistance to technology appropriation,* Proceedings of the Hawaii International Conference on System Sciences, Hawaii.

- Assisted with developing the core arguments of the paper, as well as critical review and feedback.

Fidock, J., & Carroll, J. (2010) *Theorising about the lifecycle of IT use: an appropriation perspective,* Proceedings of the 5th information systems foundations workshop: Theory Building in Information Systems, Canberra, The Australian National University.

Fidock, J., & Carroll, J. (2009) *Combining variance and process research approaches to understand system use*, Proceedings of the 20th Australasian Conference on Information Systems, Melbourne (Winner of Best Theoretical Paper).

Carroll, J., & Fidock, J. (2008) *IS project success: evaluating beyond 'on time and to budget',* Proceedings of the 3rd International Research Workshop on Information Technology Project Management (IRWITPM 2008), Paris, France.

- Assisted with developing the case description, as well critical review and feedback.

O'Toole, P., Talbot, S., & Fidock, J. (2008) Anecdotally speaking: using stories to generate organisational change, *Qualitative Research Journal, 8*(2).

- Was part of core team that applied this approach, and assisted with writing up the description of the anecdote circle process for this paper.

Fidock, J., Carroll, J., & Rynne, A. (2008) Evaluating information systems: An appropriation perspective, *4th information systems foundations workshop: Answering the unanswered questions about Design Research*, Canberra, The Australian National University.

Fidock, J., & Carroll, J. (2006) *The model of technology appropriation: A lens for understanding systems integration in a Defence context,* Proceedings of the 17th Australasian Conference on Information Systems, Adelaide.